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Studies of South American plants—V

Additional notes on Thibaudieae

ALBERT C. SMITH
(WITH THIRTEEN FIGURES)

CERATOSTEMA Juss. Gen. Pl. 163. 1789

(*Englerodoxa* Hoer. Bot. Jahrb. Engler **42**: 310. 1909)

In preparing my monograph of Thibaudieae[1] I did not have access to the type of the genus *Ceratostema* (*C. peruvianum Gmel.*). Since that time, however, I have seen that specimen in the herbarium of the Museum d'Histoire Naturelle, Paris (herb. Jussieu *7579*), and have come to the conclusion that it is congeneric with *Englerodoxa*. This conclusion was independently reached by Dr. Sleumer, who has recently[2] published his findings. *C. peruvianum*, although reported from "Peru," was probably originally collected within the present limits of Ecuador, where it has since been found by Sodiro. *Ceratostema* is represented by the five species listed below, all of which appear to be limited to Ecuador. The genus belongs in the group of genera related to *Siphonandra* and is characterized by long angled corollas swollen at the base, elongate corolla lobes, and long tubules dehiscing by oblique pores. My previous notes on *Englerodoxa* may be taken to apply to *Ceratostema*.

CERATOSTEMA ALATUM (Hoer.) Sleumer, Notizbl. **12**: 281. 1935.
Englerodoxa alata Hoer. Bot. Jahrb. Engler **42**: 311. 1909.

CERATOSTEMA PERUVIANUM Gmel. Syst. Nat. **2**: 676. 1791.

CERATOSTEMA LORANTHIFLORUM Benth. Pl. Hartw. 142. 1844.
Ceratostema chillacochense Danguy & Cherm. Bull. Mus. Hist. Nat. Par. **28**: 435. 1922.
Englerodoxa loranthiflora A. C. Smith, Contr. U. S. Nat. Herb. **28**: 352. 1932.

I have recently seen the type of *C. chillacochense* (Ecuador: *Rivet 772*, herb. Paris), which is undistinguishable from *C. loranthiflorum*.

CERATOSTEMA CALYCINUM Benth. & Hook. f. Gen. Pl. **2**: 570. 1876, nomen.
Anthropterus calycinus Spruce, Pl. exs. n. 5094, nomen.
Englerodoxa calycina A. C. Smith, Contr. U. S. Nat. Herb. **28**: 351. 1932.

[1] Smith, Albert C. 1932. The American species of Thibaudieae. Contr. U. S. Nat. Herb. **28**, part 2: 311–547. pl. 1–19.

[2] Notizbl. **12**: 279. 1935.

[THE BULLETIN FOR MAY (**63**: 237–306) WAS ISSUED MAY 4, 1936]

CERATOSTEMA ALBERTI-SMITHII (Sleumer) Sleumer, Notizbl. **12**: 282. 1935.

Englerodoxa Alberti-Smithii Sleumer, Notizbl. **12**: 57. 1934.

In view of the above disposition of the type species of *Ceratostema*, it is obvious that the 16 species which in my monograph were placed in that genus must be elsewhere referred. There having been no other available generic name, Dr. Sleumer has placed these species in his new genus *Pellegrinia*.

In my discussion of "*Ceratostema*" (loc. cit., p. 327–329) it was stressed that three distinct species groups are apparent. These groups differ from one another to such an extent that their close alliance is seriously to be doubted. I would have been inclined to recognize three genera for these species, had it not been for the difficulty of placing *Ceratostema peruvianum*. My studies since 1932 have strengthened my belief that this group is not natural, and the discovered congeneracy of *Ceratostema peruvianum* with *Englerodoxa* clarifies the situation.

In *Pellegrinia*, we have a group of four species which is characterized by continuous calyces, by anthers with slender tubules with small terminal or oblique pores, and by retrorsely pilose filaments. The anther characters are distinctly those of the genera allied to *Siphonandra*. The filaments conspicuously bear a dorsal mass of short retrorse hairs, a character not found elsewhere among the American Thibaudieae. If the genus *Pellegrinia* is to be divided, as I propose, this group must retain Dr. Sleumer's generic name. Geographically it appears to be limited to the Andes of Peru.

The remaining species of "*Pellegrinia*" have anthers with comparatively broad and flexible tubules which dehisce by elongate clefts. Such anthers are found among the relatives of *Thibaudia*, which is doubtless a close ally of these species of "*Pellegrinia*." These species fall into two groups, with clearly defined geographic limits. The first group, occurring from central Peru to northern Bolivia, will be known as *Demosthenesia*. It differs from *Pellegrinia* by its slightly dimorphic stamens, broad tubules with elongate clefts, and the sparse spreading hairs of the filaments. In superficial appearance, and in habital features such as the frequent presence of aristate stipules, the species of *Demosthenesia* closely resemble those of *Pellegrinia*, but the common characters of the two groups appear to have arisen from different ancestries. While *Pellegrinia* doubtless belongs among those smaller genera with highly specialized stamens, such as *Siphonandra*, *Demosthenesia* has the more primitive stamens characteristic, in my opinion, of the group of *Thibaudia*. Therefore, if staminal

characters are to be maintained as indicating phylogenetic history, we cannot combine *Demosthenesia* with *Pellegrinia* unless the genera *Thibaudia*, *Siphonandra*, and their allies are all combined. It is perhaps regrettable that so many small genera appear desirable in Thibaudieae, but as I have already remarked (loc. cit., p. 327), these small genera may well represent the ends of old and not very successful lines of evolution. In my opinion, the taxonomy of the group is clarified by the recognition of these genera.

The second group of the thibaudioid species of "*Pellegrinia*," occurring from northern Colombia to southern Ecuador, will be known as *Plutarchia*. This genus differs from *Demosthenesia* by its articulate calyces which are sharply contracted at the base, being obprimsatic rather than distinctly obconical. In habit it is usually more compact and sclerophyllous than *Demosthenesia*. The phylogenetic import of the presence or absence of an articulation between calyx and pedicel has not yet been sufficiently studied by an anatomist. Its use as a generic character may well be questioned, but I believe the distinct geographic ranges of *Demosthenesia* and *Plutarchia* indicate their distinct phylogeny.

Taxonomic notes on the three genera follow:

PELLEGRINIA Sleumer, Notizbl. **12**: 287. 1935.

P. grandiflora has been designated as the type species.

PELLEGRINIA COCCINEA (Hoer.) Sleumer, Notizbl. **12**: 288. 1935.

Ceratostema coccineum Hoer. Bot. Jahrb. Engler **42**: 317. 1909.

PELLEGRINIA GRANDIFLORA (R. & P.; Don) Sleumer, Notizbl. **12**: 288. 1935.

Ceratostema grandiflorum R. & P.; Don, Gen. Syst. **3**: 863. 1834.

Ceratostema longiflorum Lindl.; Lem. Fl. Serr. Jard. I. **4**: 346b. *pl. 353.* 1848.

Ceratostema Urbanianum Hoer. Bot. Jahrb. Engler **42**: 319. 1909.

PELLEGRINIA HIRSUTA (R. & P.; Don) Sleumer, Notizbl. **12**: 288. 1935.

Ceratostema hirsutum R. & P.; Don. Gen. Syst. **3**: 863. 1834.

Ceratostema cordifolium Dun.; DC. Prodr. **7**: 553. 1839.

Thibaudia hirsuta R. & P.; Dun.; DC. Prodr. **7**: 553. 1839, as synonym.

Ceratostema oblongifolium Dun.; DC. Prodr. **7**: 553. 1839.

Ceratostema Lobbii A. C. Smith, Contr. U. S. Nat. Herb. **28**: 337. *pl. 2.* 1932.

Pellegrinia Lobbii Sleumer, Notizbl. **12**: 288. 1935.

PELLEGRINIA HARMSIANA (Hoer.) Sleumer, Notizbl. **12**: 288. 1935.

Ceratostema Harmsianum Hoer. Bot. Jahrb. Engler **42**: 317. 1909.

DEMOSTHENESIA gen. nov.

Calyx cum pedicello continuus, tubo obconico, limbo suberecto quam tubo longiore, lobis plerumque 5 deltoideis; corolla subcylindrica, glabra vel pilosa, saepe ampla, lobis plerumque 5 parvis; stamina 10 corollam plus minusve aequantia, plerumque alternatim inaequalia, filamentis distinctis pilosis (pilis laxe patulis), antheris submembranaceis, loculis leviter granulosis, tubulis quam loculis 2–5-plo longioribus amplis flexilibus per rimas elongatas dehiscentibus; stylus filiformis saepe exsertus. Frutices, foliis parvis subcoriaceis breviter petiolatis obscure nerviis, stipulis plerumque aristatis mox deciduis; inflorescentiae axillares, floribus 1–3 pedicellatis.

The genus is named after the Grecian orator Demosthenes. It consists of seven known species, which are found in the high Andes from central Peru to northern Bolivia. *D. Mandoni* is designated as the type species. The genus belongs in the group of *Thibaudia*, from which it is distinct on the basis of its continuous calyces with elongate lobes, its often ample corollas, its usually slightly dimorphic stamens, its elongate tubules, and its stipules.

Demosthenesia buxifolia (Field. & Gardn.) comb. nov.

Ceratostema buxifolium Field. & Gardn. Sert. Pl. **1**: *pl. 7*. 1844.
Thibaudia microphylla Lindl. Gard. Chron. 1848: 23. 1848.
Themistoclesia buxifolia Kl. Linnaea **24**: 42. 1851.
Pellegrinia buxifolia Sleumer, Notizbl. **12**: 288. 1935.

Demosthenesia Pearcei (Britton) comb. nov.

Rusbya Pearcei Britton, Bull. Torr. Club **20**: 68. 1893.
Anthopterus Pearcei Drude; Engl. & Prantl, Pflanzenfam. Nachtr. **4**[1]: 270. 1897.
Ceratostema Pearcei A. C. Smith, Bull. Torr. Club **60**: 111. 1933.
Pellegrinia Pearcei Sleumer, Notizbl. **12**: 289. 1935.

Demosthenesia microphylla (Hoer.) comb. nov.

Ceratostema microphyllum Hoer. Bot. Jahrb. Engler **42**: 316. 1909.
Pellegrinia microphylla Sleumer, Notizbl. **12**: 288. 1935.

Demosthenesia Graebneriana (Hoer.) comb. nov.

Ceratostema Graebnerianum Hoer. Bot. Jahrb. Engler **42**: 315. 1909.
Pellegrinia Graebneriana Sleumer, Notizbl. **12**: 288. 1935.

Demosthenesia fabulosa (Sleumer) comb. nov.

Ceratostema fabulosum Sleumer, Notizbl. **12**: 120. 1934.
Pellegrinia fabulosa Sleumer, Notizbl. **12**: 289. 1935.

Demosthenesia Mandoni (Britton) comb. nov.

Ceratostema Mandoni Britton, Bull. Torr. Club **20:** 137. 1893.
Ceratostema Pilgerianum Hoer. Bot. Jahrb. Engler **42:** 318. 1909.
Ceratostema sanguineum Hoer. Bot. Jahrb. Engler **42:** 318. 1909.
Pellegrinia Mandoni Sleumer, Notizbl. **12:** 288. 1935.

Demosthenesia spectabilis (Rusby) comb. nov.

Ceratostema spectabile Rusby, Bull. N. Y. Bot. Gard. **4:** 404. 1907.
Pellegrinia spectabilis Sleumer, Notizbl. **12:** 288. 1935.

PLUTARCHIA gen. nov.

Calyx cum pedicello articulatus, tubo obprismatico basi saepe abrupte contracto, limbo suberecto tubum aequante vel quam tubo 2–4-plo longiore, lobis 5 deltoideis vel lanceolato-deltoideis; corolla subcylindrica, lobis 5 parvis; stamina 10 corollam subaequantia, filamentis aequalibus vel alternatim leviter inaequalibus plerumque parce pilosis, antheris submembranaceis, loculis leviter granulosis, tubulis quam loculis 2–4-plo longioribus amplis flexilibus per rimas elongatas dehiscentibus; stylus corollam subaequans. Frutices saepe compacti, foliis parvis coriaceis breviter petiolatis obscure nerviis, stipulis aristatis vel saepe ut videtur nullis; inflorescentiae axillares 1–3-flores saepe basi bracteis parvis paucis cinctae, floribus pedicellatis.

The genus is named after the Grecian historian Plutarch. It consists of six known species, and seems to be limited to the high Andes of Colombia and Ecuador. *P. rigida* is designated as the type species. The genus is related to *Thibaudia* and *Demosthenesia*, being distinct from the latter primarily by its articulate calyces. It also shows certain features suggestive of *Cavendishia*, and perhaps indicates a close relationship between that genus and *Thibaudia*.

Plutarchia coronaria (Linden) comb. nov.

Ceratostema coronarium Linden; Hook. f. Bot. Mag. Curtis **92:** *pl. 5575.* 1866, as synonym.
Thibaudia coronaria Hook. f. Bot. Mag. Curtis **92:** *pl. 5575.* 1866.
Themistoclesia coronilla Lind. & André, Illustr. Hort. **17:** 176. *pl. 33.* 1870.
Pellegrinia coronaria Sleumer, Notizbl. **12:** 288. 1935.

Plutarchia Rimbachii (A. C. Smith) comb. nov.

Ceratostema Rimbachii A. C. Smith, Phytologia **1:** 130. 1935.
Pellegrinia Rimbachii Sleumer, Notizbl. **12:** 289. 1935.

Plutarchia speciosa (André) comb. nov.

Ceratostema speciosum André, Illustr. Hort. **17**: 52. *pl. 9*. 1870.
Pellegrinia speciosa Sleumer, Notizbl. **12**: 288. 1935.

Plutarchia rigida (Benth.) comb. nov.

Ceratostema rigidum Benth. Pl. Hartw. 220. 1846.
Ceratostema dichogamum Cuatr. Trab. Mus. Nac. Cienc. Bot. Madrid **26**: 10. *f. 5*. 1933.
Pellegrinia rigida Sleumer, Notizbl. **12**: 288. 1935.
Pellegrinia dichogama Sleumer, Notizbl. **12**: 289. 1935.

I have carefully compared a photograph and the description of *Ceratostema dichogamum* with Hartweg's type at Kew, and am unable to find any differences.

Plutarchia pubiflora (Wedd.) comb. nov.

Ceratostema pubiflorum Wedd. Chlor. And. **2**: 181. 1855.
Pellegrinia pubiflora Sleumer, Notizbl. **12**: 289. 1935.

Plutarchia guascensis (Cuatr.) comb. nov.

Cavendishia guascensis Cuatr. Trab. Mus. Nac. Cienc. Bot. Madrid **26**: 8. *f. 3*. 1933.
Ceratostema colombianum A. C. Smith, Phytologia **1**: 130. 1935.
Pellegrinia guascensis Sleumer, Notizbl. **12**: 289. 1935.
Ceratostema guascense Cuatr.; Sleumer, Notizbl. **12**: 289. 1935, as synonym.

Species excluded from *Pellegrinia*, not included in *Demosthenesia* or *Plutarchia:*

Pellegrinia longepedicellata (Sleumer) Sleumer, Notizbl. **12**: 289. 1935 (*Ceratostema longepedicellatum* Sleumer, Notizbl. **12**: 56. 1934) = SEMIRAMISIA FRAGILIS A. C. Smith.

Pellegrinia parvifolia (Benth.) Sleumer, Notizbl. **12**: 289. 1935 (*Ceratostema parvifolium* Benth. Pl. Hartw. 220. 1846) = THIBAUDIA PARVIFOLIA (Benth.) Hoer.

Pellegrinia lanceolata (Benth.) Sleumer =

Periclesia lanceolata (Benth.) comb. nov.

Ceratostema lanceolatum Benth. Pl. Hartw. 142. 1844.
Pellegrinia lanceolata Sleumer, Notizbl. **12**: 288. 1935.

In preparing my monograph I had not seen the corollas and stamens of this plant, which was keyed as a very distinct species of *Ceratostema*. A second sheet of the type, in the herbarium of the Royal Botanic Gardens, Kew, bears corollas, which have since been examined by me. The following notes should be considered with the description recently published (loc. cit., p. 344):

Corolla thin carnose, 33–40 mm. long, 5–7 mm. in diameter, densely pale pilose (hairs 0.5–0.8 mm. long) without, glabrous within, the lobes 5, oblong-lanceolate, subacute, 10–12 mm. long, about 4 mm. broad at base; stamens 10, nearly as long as corolla, the filaments glabrous, lightly connate in a tube about 2 mm. long, the anthers rigidly erect, the sacs granular, 8–10 mm. long, incurved at base, the tubules membranous, rigid, very slender, about 0.3 mm. in diameter near apex, about 20 mm. long, opening by oblique pores about 0.5 mm. long; style filiform, about as long as corolla.

The species cannot be left in *Ceratostema* (*Englerodoxa*), nor can it be placed in *Pellegrinia*, from which it is excluded by the articulate calyx and the lack of retrorse hairs on the filaments. Its stiff slender tubules remove it from *Plutarchia*. Its proper place in *Periclesia* is indicated by the glabrous connate filaments, the stiff slender tubules opening by oblique pores, the articulate large-lobed calyx, and the subterminal 2- or 3-flowered inflorescence (the flowers not being solitary as previously described). In addition, the plant bears a marked habital resemblance to the only previously recognized species, *Periclesia flexuosa* A. C. Smith, from which it differs by its pilose branchlets and leaves, its 5-merous flowers, narrower less membranous calyx lobes, shorter filaments, etc. The inclusion of a species with 5-merous flowers does not weaken the genus *Periclesia*, which depends primarily upon a combination of calyx, anther, and habital characters not found in its allies.

Cavendishia Martii (Meissn.) comb. nov.

Thibaudia Martii Meissn.; Mart. Fl. Bras. **7**: 173. 1863.
Cavendishia paniculata Rusby, Mem. Torr. Club **4**: 215. 1895, and other synonyms listed in my monograph (loc. cit., p. 482).

Having examined a photograph of the type of *Thibaudia Martii*, I find it necessary to replace the well-known *Cavendishia paniculata* by an older name. The two types are essentially similar. The older type, said to have been collected in Brazil, was more likely from southern Peru, in the Amazon drainage basin.

CAVENDISHIA STROBILIFERA (HBK.) Hoer. Bot. Jahrb. Engler **42**: 279. 1909.

Thibaudia strobilifera HBK. Nov. Gen. & Sp. **3:** 272. 1818, and other synonyms listed in my monograph (loc. cit., p. 509).

Cavendishia acuminata (Hook.) Hemsl. Biol. Centr. Amer. Bot. **2:** 272. 1881 (*Thibaudia acuminata* Hook. 1837, and other synonyms listed in my monograph (loc. cit., p. 503, 504)).

Having recently examined the type of *Thibaudia strobilifera* in the herbarium of the Museum d'Histoire Naturelle, Paris, I find it substantially identical with the widespread *Cavendishia acuminata*, which name consequently must be replaced.

POLYCLITA gen. nov.

Calyx coriaceus cum pedicello continuus, tubo obprismatico basi longe attenuato lobis 5-angulato vel anguste alato, limbo erecto tubum subaequante, lobis 5 brevibus; corolla carnosa cylindrica, lobis 5 parvis; stamina 10 aequalia corollam subaequantia, filamentis brevibus basi leviter cohaerentibus, loculis granulosis rigidis gracilibus, tubulis quam loculis paullo brevioribus amplis flexilibus per rimas elongatas dehiscentibus; stylus crassus corollam subaequans. Frutex, foliis coriaceis breviter petiolatis; inflorescentiae axillares subfasciculatae vel brevissime racemosae, floribus 2–6 pedicellatis.

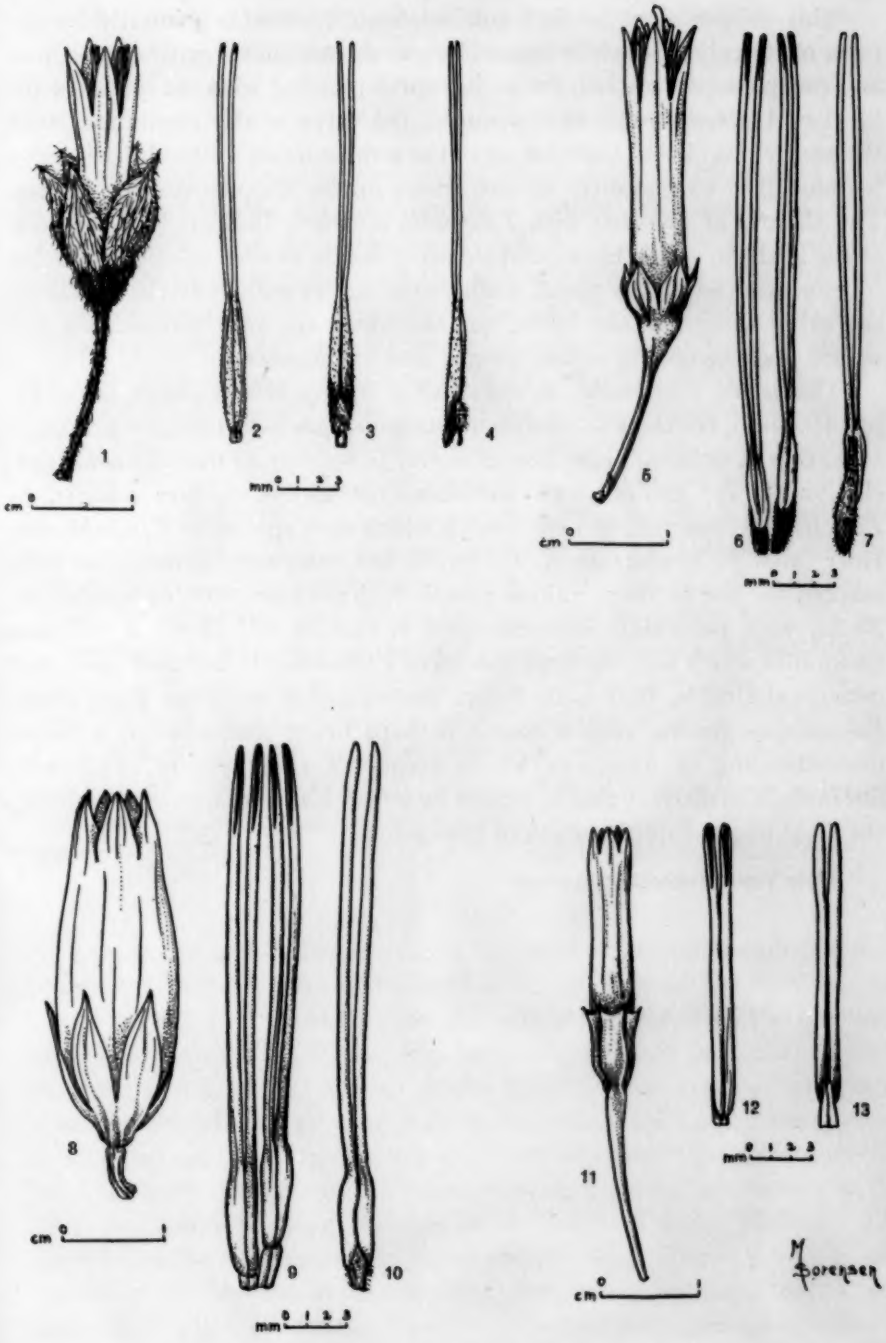
The genus is named after the Grecian sculptor Polyclitus. It is apparently monotypic, known only from the type collection from Bolivia.

Polyclita turbinata (Kuntze) comb. nov.

Chupalon turbinatum Kuntze, Rev. Gen. Pl. **3**^{2}: 190. 1898.
Thibaudia turbinata Hoer. Bot. Jahrb. Engler **42:** 272, 1909.

Explanation of figures

Fig. 1. Flower of *Pellegrinia hirsuta*.
Fig. 2. Stamen of *Pellegrinia hirsuta*, ventral surface.
Fig. 3. Stamen of *Pellegrinia hirsuta*, dorsal surface.
Fig. 4. Stamen of *Pellegrinia hirsuta*, lateral surface.
Fig. 5. Flower of *Demosthenesia Mandoni*.
Fig. 6. Stamens of *Demosthenesia Mandoni*, ventral surface.
Fig. 7. Stamen of *Demosthenesia Mandoni*, dorsal surface.
Fig. 8. Flower of *Plutarchia rigida*.
Fig. 9. Stamens of *Plutarchia rigida*, ventral surface.
Fig. 10. Stamen of *Plutarchia rigida*, dorsal surface.
Fig. 11. Flower of *Polyclita turbinata*.
Fig. 12. Stamen of *Polyclita turbinata*, ventral surface.
Fig. 13. Stamen of *Polyclita turbinata*, dorsal surface.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This unique plant is distinguished from *Thibaudia* primarily by the form of its calyx, which is much elongated, continuous with the pedicel, and conspicuously angled, the angles corresponding with the lobes. In the Section *Agathothibaudia* of *Thibaudia*, the calyx is also continuous with the pedicel, but in that section, as in the remainder of *Thibaudia*, the calyx is rounded at base and the inconspicuous angles are opposite the sinuses. The alliance of *Polyclita* with *Thibaudia* is clearly indicated by the form of the anthers, which have short broad cylindric flexible tubules dehiscing by elongate clefts. The genus *Anthopterus* agrees with *Polyclita* in having the calyx winged to the lobes, but the wings are very conspicuous and veined and the corolla is also winged and membranous.

The genus *Thibaudia*, as constituted in my recent paper (loc. cit., pp. 410–439), contains several elements which are held together primarily by anther structure. These elements are: 1. Section *Agathothibaudia* (species no. 1, 2); 2. *Thibaudia turbinata* (species no. 3, here referred to *Polyclita*); 3. Species no. 4–19, among which such species as *T. apophysata* Hoer. and *T. involucrata* A. C. Smith are extremely anomalous, each marked by one or more unique morphological characters; 4. Species no. 20–23, with paniculate inflorescences; 5. Species no. 24–40, a coherent group into which falls the type species of *Thibaudia*. It is conceivable, and perhaps desirable, that some future monographer recognize these many elements as genera, such a course perhaps being conducive to a clearer understanding of American Vacciniaceae. Of these groups, *Thibaudia turbinata* is so distinct that it cannot be left in *Thibaudia*, even permitting the most liberal interpretation of that genus.

NEW YORK BOTANICAL GARDEN

Further fossil studies of the Two Creeks Forest Bed, Manitowoc County, Wisconsin

L. R. Wilson

(WITH ONE TEXT-FIGURE)

In 1930–1931 a detailed study of one hundred feet of the exposed forest bed southeast of Two Creeks, Manitowoc County, Wisconsin, was made (Wilson, 1932). The glacial and ecological histories were discussed and shown to be an important phase in the biotic conditions associated with the later advances of the Wisconsin ice sheets. At that time it was noted that other exposures existed several miles northward in the clay banks on the lake shore. These exposures when investigated proved to have a slightly different history from those of the more southern exposure. The soils upon which the fossil forest developed are in places sandy instead of a heavy red clay. The soils above the forest bed horizon are varied and indicate that they were deposited in ponded glacial waters. With ecological and glacial conditions differing slightly from the southern exposure the present investigation was undertaken in hope that a fuller biological knowledge of the Forest Bed Subinterval might be gained.

Several field trips, during the past three years, have been made to the northern exposures where materials were collected for further study. In June 1933 and May 1934 one portion approximately thirty feet in length was critically examined for organic remains, and the results recorded are from this part of the forest bed. The location of this exposure is on the lake shore approximately seventy-five yards south of the Kewaunee-Manitowoc County line in Section 2, Township 21 North, Range 24 East.

GEOLOGY

Though the soils below the forest bed were not completely exposed, it is assumed that the general features of the geology at the northern exposure of the Two Creeks Forest Bed are the same as at the exposure three miles southward. These may be briefly outlined in their historical sequence as follows: (1) The ice of the Third Wisconsin Substage (Cary) deposited till, which is exposed near the base of the cliffs when not covered by slumped soils from above. (2) The Cary ice front then melted northward beyond the Straits of Mackinac, forming a glacial lake known as the Glenwood Stage of Lake Chicago in the basin of Lake Michigan and varved clays were deposited on top of the till. These varves are quite distinct near the lower contact but disappear toward the top, indicating a change in the lake conditions. As the result of drainage through the Straits of Mackinac the lake level fell to a level probably below the present one of

Lake Michigan. (3) The forest, now represented by fossils at Two Creeks, Manitowoc County, Wisconsin, established itself upon the land thus exposed above the lake. (4) Ice of the Fourth Wisconsin Substage (Mankato) began to advance from the Patrician center upon the region, water was ponded throughout the forest, and sediments were deposited over the area in the various thicknesses. (5) The area was then overridden by the ice and till was deposited over the sediments causing much folding and disturbance. (6) Upon the retreat of the Mankato Ice varved lake clays and some sands were irregularly deposited over the till. (7) Subsequent wave work has exposed the forest bed as it appears today.

Fig. 1. Forest bed horizon with spruce log and stump *in situ*.

At one place in the northern exposure the soils immediately below the forest bed are stony. This condition has not been seen at any other place, and it might be suggested that these soils originated from till borne on an iceberg in Early Lake Chicago, which grounded at this place.

The events which took place during the destruction of the forest at this particular location are complex. Complete explanation cannot be attempted with present data. However, a few tentative conclusions concerning the deposits above the forest bed are worth recording. The deposit immediately overlying the forest bed remains is a layer of red calcareous clay about one-half inch in thickness. This deposit seems to indicate deep water. Overlying the clay is a layer of sand containing much silt. This varies from eight to fourteen inches in thickness (fig. 1). Above the sand

another layer of red clay is found. This is about eight inches in thickness and has a blocky structure. In these deposits organic remains are surprisingly scarce until the top of the second layer of clay is reached. Here are found a few spruce needles and twigs. Above this clay there is a coarse silty sand containing much organic matter. The top of this deposit is indistinct in its contact with what appears to be a very sandy till. Many logs from the forest bed are found near this upper contact usually partly buried in each deposit, but also often completely buried in one or the other. As in the case farther south, the majority of the logs point southwest-northeast.

One log, seven feet long (fig. 1), was found partly attached to its stump, and leaning at an angle of forty-five degrees. No other log has ever been found as nearly upright as this one. It was not completely pushed over because at this particular place in the fossil forest about three feet of sedimentary deposit accumulated before the ice reached the spot. When the ice did override the area it apparently pushed this tree over to an angle of forty-five degrees in the soft mud and sand. Then it tore off the portion which protruded from the sediments leaving a shredded and twisted end to the log. This shredded character of the wood is indicative of live or very recently killed timber.

FOSSILS

The remains of fossil organisms are found in abundance at the more northern exposure and constitute, with the exception of mollusca, nearly the same organisms as are found at the southern exposure of the forest bed.

Spruce wood in form of logs, twigs, and bark is the most abundant type of fossil material. It occurs both in the forest bed horizon and above in the sediments and till. Most of the logs are four to six inches in diameter and the number of annual rings range from sixty to one hundred and forty-two. The oldest log previously found has only eighty-two annual rings. A few logs were found that are about twelve inches in diameter, but these do not have more than eighty to one hundred and twenty annual rings. All logs examined showed a marked decrease in the width of the annual rings near the bark. This apparently is due, at least for those trees that grew at the present exposure, to excessive ponding of water about their trunks as the Mankato Ice advanced southward.

Needles and cones of spruce are present, though the latter are comparatively scarce. The cones belong to the species black spruce, *Picea mariana* (Mill.) BSP., as presumably do the logs and needles. There is a possibility that some of the larger logs are white spruce, *Picea glauca*

(Moench.) Voss., but there is no definite proof at present for this statement.

In the sediments three feet above the forest bed were found fragments of twigs of balsam fir, *Abies balsamea* (L.) Mill., with their needles attached. This species of tree has not previously been recorded in buried Pleistocene deposits of Wisconsin. The only explanation that can be given is that the twigs and needles were transported from a more northern location with the sediments in which they occur. There is evidence at the southern exposure of such transportation in the occurrence of a rock-dwelling moss and a large log that does not show the narrow annual rings at the outside.

Only seven species of mosses were found in the northern exposure as compared with nineteen in the southern. Apparently the local conditions are to be considered as the limiting factor. The moss material was submitted to Mr. L. S. Cheney, of Barron, Wisconsin, who identified the following species: *Bryum bimum* Schreb., *Calliergon turgescens* (Jens) Kindb., *Camptothecium nitens* Schp., *Campylium stellatum* (Schreb.) Bryhn., *Ditrichum flexicaule* Hampe, *Drepanocladus revolvens*, var. *intermedius* (Lindb.), and *Scorpidium Scorpioides* (L.) Limpr. All of these species except the var. *intermedius* of *Drepanocladus revolvens* have previously been recorded from the Two Creeks Forest Bed.

The microscopic plant fossils were observed only in the forest bed level and were studied after the usual manner employed by paleo-ecologists (Erdtman, 1931). The forest bed horizon is about two inches thick, with the upper one-half inch composed of mosses and spruce forest litter and the lower one and one-half inches is mainly silt and organic material of sedimentary origin, and is leached. The whole horizon was separated into four levels as follows: (1) lowest silt containing organic tissues, (2) silt in contact with the forest litter, (3) lower forest litter and, (4) upper litter and mosses in contact with the calcareous clay overlying the forest bed. These samples were dissected for macroscopic tissues and then prepared for microscopic examination.

In the two lowest levels no pollen or spores were found but in the forest litter comparatively large quantities of spruce (*Picea*) pollen occurs. Two very thick-walled guard cells of the type commonly found in the sedges were also found in the litter, but aside from these no other species have been found as microfossils. In the southern exposure one pollen grain of jack pine (*Pinus Banksiana*), two pollen grains of birch (*Betula* sp.), one of a heath and one spore of a fern (*Asplenium* sp.) were found, but none of these species have been found in the present exposure. Because of

the scarcity of jack pine and birch pollen it was suggested that these had been blown into the forest from a distance.

An analysis of the peat suggests that the forest was probably a solid formation of upland spruce. The floor of the forest appears to have had a very sparse covering of moss, sedges and dead spruce needles. The animal fossils are rare except for shell remains of protozoa. These occur in the sediments below the forest litter; genera represented in lowest levels are *Difflugia* and one resembling *Nodosaria*, while in the highest level only *Difflugia* was found. In the lower forest litter several mites were observed, but not identified. One log that has bark beetle excavations upon it was excavated from the sedimentary deposits above the forest bed. These apparently were made by only one genus or species of beetle.

No mollusca were found in the present exposure, while at the southern location eight species were identified and the deposit contained many individuals.

ECOLOGICAL HISTORY OF THE NORTHERN TWO CREEKS EXPOSURE

The ecological history of the northern exposure of the Two Creeks Forest Bed begins with the development of a shallow body of water probably at the time when the Cary Ice front was melting back beyond the Straits of Mackinac and Early Lake Chicago was being drained. In this shallow body of water aquatic animals began to establish themselves. At the location under discussion there occurred only protozoans as far as can be established by the fossil remains. At the more southern exposure however, several species of mollusca were found in the silt below the forest bed, and it is possible that these likewise occurred here, but as yet have not been found. The protozoans represented as fossils are necessarily those that build shells, which persist after the death of the organism. Two genera occur in the silts below the forest litter, and the former is much more abundant than the latter.

As the water level dropped the number of protozoan shells decreased until near the contact of the silt and forest litter none were found. This absence may be due to the brief weathering of the top soils which occurred on dry land, but the interval was too short for a definite soil profile to develop.

When dry land was formed sedges and mosses became established probably at the same time or shortly before the colonization by spruce trees. Black spruce and possibly white spruce became established in a solid formation upon the soils of the area. The forest thrived for more than one hundred years before any deterioration was noted by the decreasing

width of the growth rings in the logs. Some trees may have become infected with bark beetles at this time as one rather large log collected at this location, as well as one at the southern exposure showed bark beetle excavations. Mites also appear to have been abundant during the forest stage.

As the Fourth Wisconsin or Mankato ice sheet began to advance southward, it blocked northward drainage of Early Lake Chicago through the Straits of Mackinac and the water rose in the Lake Michigan basin. Conditions in the forest bed became wetter for wet land and mosses developed abundantly. There is a reappearance of the *Difflugia* shells, indicating the presence of shallow standing water. Then there was a general influx of water over the area and the forest was drowned and buried several feet deep in lacustrine sediments.

THE TWO CREEKS FOREST IN LIGHT OF RECENT PALEO-ECOLOGICAL WORK IN WISCONSIN

In the earlier paper discussing the Two Creeks Forest Bed and its climatic indication it was stated that two conflicting pieces of evidence were present in the form of the prevailing ranges of the plants and the prevailing ranges of the animals. It was suggested that the animal evidence might to some extent be discredited, because those represented in the forest bed as fossils belong to technical groups whose absolute ranges are still imperfectly known. Now, it appears that a reconsideration of the plant evidence might bring about a closer agreement with that of the animals.

Recently, considerable peat pollen work has been done in Wisconsin that furnishes information bearing on the ecology of the Two Creeks Forest Bed. Two deposits of peat have been studied which apparently began to form upon the recession of the Third Wisconsin or Cary Ice, as did the peat at Two Creeks. The best argument for this statement is the presence of peat at the forest bed, for it is logical to assume that peat or organic sediments were forming in ponded areas of the same age if it was possible for peat to accumulate on high ground such as that upon which the forest bed developed. The two deposits referred to above are located, one near Waupaca, Waupaca County, Wisconsin (Voss, 1931); the other, near Lodi, Columbia County, Wisconsin (Truman, 1933). Unlike the peat at the forest bed, these two deposits were not covered upon the advance of the Fourth Wisconsin or Mankato Ice, consequently they should contain not only a record of the flora existing near them at the formation period of the Two Creeks Forest Bed, but also that which existed during the advance of the Mankato Ice and subsequent time. If this is true, then

it is possible to trace the vegetation in its development up to recent time and compare the components of each including those of the fossil forest.

At the bottom of the Waupaca deposit Voss reports finding pollen of *Picea*, *Abies*, *Pinus*, *Quercus*, *Tilia*, and *Ulmus*. The first two genera each make up 40% of the spectrum, *Pinus* 10%, *Quercus*, *Tilia* and *Ulmus* together 5%, and 5% of other species. Truman records 26% *Picea*, 4% *Abies*, 1% *Pinus*, 24% *Larix*, 20% *Gramineae*, 10% *Alnus*, and 15% other species of pollen at the bottom level in the Lodi deposit. The pollen spectrum at the northern exposure of the Two Creeks Forest Bed is 100% *Picea* while at the southern exposure it is 97.5% *Picea*, 1% *Betula*, 0.5% *Pinus*, 0.5% *Asplenium*, and 0.5% *Ericaceae* computed from a count of two hundred fossils. Though it is still early in the stage of investigation, these observations suggest the following picture of the vegetation in eastern Wisconsin during the interval between the Third and Fourth Substages of the Wisconsin glaciation.

On the eastern side of the state near Lake Michigan the forests were dominantly *Picea* while to the westward and southward *Picea* and *Abies* were associated with *Pinus* and several species of deciduous trees. Farther southward *Picea* and *Abies* occurred in still lesser quantity and *Larix*, other deciduous trees and the herbaceous flora were more abundant. If this is true description of the vegetation it might be possible to explain such a distribution on the basis of climatic conditions. However, it may also be explained as an illustration of plant succession governed by physiography and speed of migration similar to the present conditions in Alaska (Rigg, 1934).

Today the northern part of Wisconsin is a floral transitional region, where species of the Canadian Flora meet elements from the Alleghanian, Prairie and Coastal Plain floras. The dominance of the Canadian flora may possibly be explained by the presence of a very young topography throughout most of the region. This is responsible for the ecological conditions which are favorable to the northern type of vegetation, while climate seems to be only a secondary factor of plant distribution in Wisconsin.

There might be some question concerning the larger number of plant species appearing in the basal levels of the two deposits reported on by Voss and Truman than found in the forest bed. If the two areas were colonized by *Picea* and *Abies* before the other trees arrived at the respective locations, why then is there not a level recorded in the bogs equivalent to that shown at the forest bed? In explaining this it is necessary only to point out that both the Waupaca and Lodi basal deposits were formed in ponds and the forest bed peat was formed above water. Though the deposition of sediments might be comparatively uniform in the bodies of

water, the first organic sediments in contact with the mineral soils are deposited rather irregularly. Greater disturbance of microfossils takes place in water than on land and consequently the stratigraphy cannot be as accurate.

Truman, in discussing a possible correlation of one level in the Lodi peat deposit with the Two Creeks Forest Bed states, "The writer suggests that the two high points in the frequency of *Larix* may correspond to successive readvances of the ice [Fourth and Fifth Wisconsin Substages or Early and Later Mankato], and that the intervals of low frequency preceding and separating them characterized by the presence of *Picea* and *Pinus* may be comparable to interglacial periods such as that represented in the development of the Two Creeks Forest Bed described by L. R. Wilson (1932) in which he finds *Picea* the dominant forest component."

The pollen graph presented by Voss for the Waupaca bog does not show any fluctuation of its components that would lead one to make any correlation with the two later ice advances such as is made by Truman. It may be that there was no effect upon the existing vegetation by the readvances of the ice fronts at that location, or that his samples of peat were not collected close enough together to show such fluctuations.

In a study (unpublished) of ten bogs associated with the Glacial Great Lakes in Douglas County, Wisconsin, the writer found that the earliest vegetation in the region was *Picea* and *Pinus*. As the levels of the Glacial Great Lakes became progressively lower with halts of considerable duration at each stage, *Picea* followed on the newly exposed soil as the pioneer tree. It was found that other tree pollens appeared at levels in the bogs a little above the bottom indicating that succession was taking place. Each stage of the Glacial Great Lakes was first bordered by a *Picea* forest a few miles wide while beyond that grew trees belonging to later stages of succession. Such a forest succession cannot be considered as climatically controlled. This development of the forests in the Lake Superior region may be a clue to what would have happened in the fossil forest at Two Creeks had the time interval been somewhat longer.

SUMMARY

1. The exposure here discussed belongs to the same time interval and was connected with the more southern exposure of the Two Creeks Forest Bed described in an earlier paper.

2. The same general geological history is evident at both locations but the northern exposure shows thicker deposits of sedimentary materials over the forest bed before it was overridden by the Mankato Ice.

3. The fossil forest is composed entirely of spruce which developed in some places on sandy soil and at other places on rocky clay.

4. The ecological history suggested by the fossils is, (a) a shallow pond in which occurred protozoa and probably other invertebrates, (b) a spruce forest containing trees of 4 to 12 inches in diameter with as many as 142 annual rings, mosses, sedges, mites, and wood boring beetles, (c) wetter conditions with water mosses and *Difflugia*. This is essentially like the ecological history of the southern exposure.

5. The fossil evidence as a climatic index is discussed in the light of recent investigations, and it is suggested that though the fossil plants have a decided boreal character they also represent the pioneer organisms of denuded areas under certain conditions and are therefore not reliable indicators of a severe climate.

The writer wishes to express his appreciation to Mr. L. S. Cheney for the identification of the mosses and to Mr. F. T. Thwaites and Dr. N. C. Fassett for their helpful criticism and discussions during the course of the work.

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Literature cited

Erdtman, G. 1931. Pollen statistics: a new research method in paleo-ecology. Science N. S. **73**: 399–401.

Lawson, P. V. 1902. Preliminary reports of the forest beds of the lower Fox. Wis. Geol. Nat. Hist. Soc. Bull. 17: 61–62.

Rigg, R. F. 1934. The edge of the forest in Alaska and the reasons for its position. Ecology **15**: 80–96.

Thwaites, F. T. 1934. Outline of the glacial geology. Edwards Bros., Ann Arbor, Mich.

Truman, H. V. 1933. The stratigraphy and pollen analysis of the Gibraltar Bluff peat bog. Ph.D. thesis, Univ. of Wis. (unpublished).

Voss, John 1931. Preliminary report on the paleo-ecology of a Wisconsin and an Illinois bog. Trans. Ill. State Acad. Sci. **24**: 130–136.

Wilson, L. R. 1932. The Two Creeks Forest Bed, Manitowoc County, Wisconsin. Trans. Wis. Acad. **27**: 31–46.

The genus Delphinium in North America: series Pelligerae of subsection Subscaposa

JOSEPH EWAN

Delphinium has apparently undergone long-continued fragmentation in western North America, having differentiated into what may be termed "series," that is, species-groups characterized by a morphological character of the seed or flower. Such series have phylogenetic significance and each is marked by a distribution which is both characteristic and separate. The present paper treats of those species which inhabit the interior deserts of the southwestern United States, constituting what is here defined as the series Pelligerae. They share a peculiar seed character, namely, that the dark-bodied seed is wholly enveloped by a white-papery pellicle, often ample and much exceeding the dimensions of the seed proper. The five species here considered are set apart from the cismontane Delphiniums of the Pacific Coast by this papery-tegumented character of the seed. Hints as to the mechanics of this process of fragmentation or speciation in the genus have come to mind as the study has proceeded. These suggestions are discussed under each species treated.

The studies here recorded were begun at the University of California at Los Angeles at the suggestion of Dr. Carl Epling to whom I extend my gratitude. In addition to the material there, large and important collections were made available by the United States National Herbarium and by the following California herbaria: Stanford University, the University of California and the working collection of Dr. W. L. Jepson there, Pomona College, the California Academy of Sciences, the Los Angeles (County) Museum (including the Davidson Herbarium), the Santa Barbara Museum of Natural History, and by Mrs. Marjorie Clary of Coachella and Mr. Frank W. Peirson of Altadena. Critical material and types were generously loaned by the New York Botanical Garden. Mr. C. A. Weatherby kindly supplied data and photographs upon repeated requests from the Gray Herbarium; in a like manner Dr. Theodor Just of Notre Dame University, from the Herbarium Greeneanum. Several friends have collected and placed at my disposal pertinent material which has always proved of value or interest. I express my appreciation to all these many contributing botanists, curators and friends for this unstinted cooperation.

HISTORICAL NOTE

Of the five species treated here two are of widespread distribution; three are highly restricted endemics. It is partly by reason of this that

much of the confusion has arisen. The earliest published species of the series Pelligerae is *D. scaposum* of Greene (1881), a plant hardly to be confused with others of its region, although long made to include the rarer subscapose forms of *D. amabile*. It is a widespread and distinct element of the Arizona flora and not to date positively known from California.

Prior to this, however, the second widespread species of the Great Basin (*D. amabile*) had been known as *D. azureum* of Michaux (1803). This was a misconception, however, for Michaux's species does not occur west of the Rocky Mountains but ranges from the south Atlantic states to the central Mississippi Valley and northward to Saskatchewan. It is upon the varied interpretation of this widespread Great Basin species that the confusion in the published treatments has arisen.

In 1887 Gray published his "attempt to distinguish the North American species." In this six-page paper Gray provided no descriptions of the five newly proposed species, but relied solely upon the diagnoses provided by a synoptical key. Consequently subsequent botanists have found it difficult, indeed, to interpret Gray's inadequately characterized proposals. Among the species proposed was *D. Parishii* based upon a collection made at Palm Springs, Riverside County, California. This endemic is restricted to a small area along the western margin of the Colorado Desert of California. Nevertheless, as interpreted by most subsequent authors, Gray's name was made to embrace forms as far east as southern Utah. In 1912 Rydberg published *D. coelestinum* based on Edward Palmer's collection at St. George, Utah. He, along with some subsequent authors, later attributed to it forms of the southern Great Basin and its westward extension, the Mohave Desert. Such a view is correct. However, as pointed out by Tidestrom (1925), the name is not valid but a homonym in the genus. Accordingly he proposed the name *D. amabile* by which this widespread species is properly known. Another element of confusion was added by reason of the fact that the type of *D. coelestinum* and hence of *D. amabile* was collected at its easternmost limit, for the plants of that region are not typical of the species as it occurs more abundantly to the west.

Hence there were described from nearly opposite corners of the western deserts two *Delphinium* species, each in turn being interpreted by various authors up to the present as embracing the populations lying between these points. It is true that two species are here involved. As mentioned above, however, *D. Parishii* is much restricted and does not occur through the wide range ordinarily attributed to it.

With such unpropitious beginnings and the well known variability among its species, leading Brewer and Watson (1876) to remark that "the species of this genus are variable in so many directions that it is difficult to satisfactorily limit or define them," our western Delphiniums have re-

mained poorly understood despite the summation of the North American species by Gray (1895) and by Davis (1900), of the southern California species by Davidson (1908) or that of the species for the entire state by Jepson (1915).

The five species treated here lie within the diverse aggregate designated by Huth in 1895 as "Tribus Subscaposa" (hereinafter designated as "Subsection Subscaposa," an alteration to conform to Art. 12, Intern. Rules of Bot. Nomencl., 1930), which embraced such unlike species as *D. decorum*, *Parishii*, *nudicaule* and *camporum*. In spite of its comprehensive nature Huth's treatment of the genus is, in general, coherent and determinate even with respect to the North American species which he knew but sketchily from limited herbarium materials.

USE OF THE CATEGORY SUBSPECIES

The category subspecies has been adopted here since the author believes that: (a) it expresses relationship, in the same way that "subgenus" relates itself to genus, and has the advantage over the term "variety" of being at once oriented with respect to established taxonomic grouping, (b) it connotes emergence, or the recent origin in geologic time of the phase from a larger parent plexus, and that (c) it escapes confusion attending the use of the category "variety" in both scientific and popular usage, from the inexact horticultural sense to its use in systematic botany where it may vagrantly represent at one time a mere color variant or other minor morphological form, or again may serve as equivalent of the present concept "subspecies." The author is cognizant that the term "variety" is currently employed by many workers in exactly the sense here attributed to the category "subspecies." It is felt, however, that the use of the latter term, in growing favor among investigators who have adopted it essentially for the reasons outlined above, has sufficient advantages to be deserving of wide use.

TERMINOLOGY

The leaf blade of the *Delphinium* species here treated is normally cut into three or five principal divisions. These I have termed the primary segments. They in turn are variously incised or lobed usually once, sometimes twice, rarely more, and such lobes are referred to as the ultimate segments. The ultimate segments may sometimes be even pectinate. Nipple-mucronate refers to a white nipple-like mucro or callosity occurring at the apex of the whole blade alone or at the apices of the ultimate segments. Flower length equals the extreme measurement from spur-tip to tip of the sepal most nearly on the same plane with it. And likewise, sepal length equals the extreme measurement from the thickened summit

of the pedicel to the tip of a lateral sepal (commonly somewhat larger in both dimensions than the upper or lower sepals). Follicle length does not include the cusp, which is of variable length in different species and within the same species.

Subsection Subscaposa nom. nov.

Tribus *Subscaposa* Huth, Engler's Jahrb. **20:** 445. 1895.

Series Pelligerae series nov.

Semina perspicue integumentis laevibus amplissimis niveis atque chartaceis nequaquam alatis neque squamosis neque transverse rugoso-squamellatis.

Desert-dwelling perennials of scapose or subscapose habit with seeds distinctly inclosed within a smooth loose crepe-white papery pellicle—never winged, echinate nor "becoming transversely rugose-squamellate."

KEY TO THE SPECIES OF SERIES PELLIGERAE

A. Sinuses of the lower petals 3–4 mm. deep; leaves strictly basal, with a close pubescence or glabrous, the primary segments obovate or even subspatulate, the ultimate segments broadly rounded, nipple-mucronate; flowers clear dark or royal blue; Arizona and contiguous Nevada and New Mexico. 1. *D. scaposum*

AA. Sinuses of the lower petals less than 2.5 mm. deep; leaves predominantly cauline (if basal then plants decidedly hairy or pale-flowered), the primary segments linear to broadly cuneate-oblanceolate, the ultimate segments acute or acuminate, apiculate or sometimes nipple-mucronate; flowers blue-purple to whitish; Mono County, Calif. to s. Utah, south to S. Arizona and Lower California.

B. Stem stout and strict, often hollow, 20–40 cm. tall, arising in well developed plants from a thickened crown with 3–5 woody-fibrous roots; leaves reduced and withering at flowering time and not noticeable or if persistent then thick and somewhat fleshy; drainages of the Mohave Desert and southern part of Great Basin. 2. *D. amabile*

BB. Stem erect (but scarcely stout) or lax or even reclining, slender, 30–60 cm. tall, arising from a usually single or sometimes two or three fibrous roots, the stem being scarcely thickened into a crown; leaves evident, not withering at flowering time yet not thickish or if withering then linear-pectinate divided; drainages of the Colorado Desert.

C. Leaves variously hirsute; mature follicle cluster nearly as broad as long (6–12 mm.), subglobose in outline. 3. *D. subglobosum*

CC. Leaves glabrous and glaucous (occasionally pubescent when young); mature follicle cluster distinctly longer than broad (12–20 mm.), oblong in outline.

D. Primary leaf divisions narrowly oblong (aver. 4–7 mm. wide medially) with the ultimate segments linear-divided; flower dark blue or purple. 4. *D. collinum*

DD. Primary leaf divisions broadly cuneate (aver. 8–15 mm. wide medially) with ultimate segments broadly lobed; flowers azure blue. 5. *D. Parishii*

1. DELPHINIUM SCAPOSUM Greene

Delphinium scaposum Greene, Bot. Gaz. **6:** 156. 1881, based on specimen collected by *Greene* at Gila Bluffs, New Mexico, 25 IV 1881 (date changed by Greene from 1880 over the printed label). Type, as indicated by Greene (Calif. Acad. Sci. Herb. no. 233), examined.

D. decorum F. & M. var. *scaposum* Huth, Helios **10:** 33. 1893.

Strikingly scapose perennial, herbage light grass-green, glabrous or nearly so (esp. in early season specimens) or with a close even chamois-like pubescence, never hirsute or coarsely pubescent; stems erect, usually one- to few-stemmed or occasionally freely branching from the base, 30–45 cm. tall, arising from a slender woody-fibrous rootstock; leaves wholly basal (rarely also cauline in plants from northern parts of its range), decorative, pentagonal or triangular in outline, with 3 to 5 primary divisions, these cuneate-obovate or subspatulate with few ultimate teeth or lobes, these nipple-mucronate; raceme open, 5–10-flowered; flowers 22–28 mm. long, the sepals intense royal blue (spur commonly darkening in age in the herbarium to a darker bronzy color, the remainder blue, thus characteristically bicolored), or a lighter bright blue, lanceolate, abruptly acute, 13–15 mm. long, the upper petals white, blue-tinged or -tipped, emarginate, the lower petals dark blue, their blades ovate, cleft below the middle to form a nearly closed but deep sinus 3–4 mm. deep; follicle cluster ovate or oblong, 10–20 mm. long, glabrous; seeds dark brown with a sordid white-membranous papery pellicle.

Representative material: NEW MEXICO: Grant Co.: Hills along the Gila, *Greene* 25 IV 1880 (or 1881). McKinley Co.: (Old Fort) Wingate, *Matthews* (fide Huth). ARIZONA: Pima Co.: Tucson, *Toumey* in 1894; Baboquivari Mts., *Fosberg* 7463; Covered Wells (5 mi. w.), *Fosberg* 7462. Gila Co.: San Carlos, *Ethel Palmer* in 1932 (albino but with usual dark spur!). Yavapai Co.: Skull Valley, *Jones* in 1903; Prescott, *Peebles & Harrison* 4001. Coconino Co.: Flagstaff, *Purpus* 7073. Mohave Co.: Yucca, *Jones* 3894; Peach Sprs., *N. C. Wilson* in 1893. UTAH: Kane Co.: Kanab, *Jones* 5286a. Washington Co.: Springdale, *Jones* 5237. Grand Co.: Moab, *Eastwood* in 1892. Sevier Co.: Vermillion, *Jones* in 1901. COLORADO: Montezuma Co.: Mancos, *Eastwood* in 1892. Montrose Co.: Paradox, *Walker* 74. Delta Co.: Delta (mesa west), *Tidestrom* 2193. NEVADA: Clark Co.: Eldorado Canyon at Nelson, *Jones* in 1907.

This handsome species with racemes of rich royal blue flowers is certainly the most striking of the deserticolous Delphiniums. Two recognizable races of this species, outlined below, appear over its range. They conform so closely with the topography of Arizona resulting from great geomorphogenic adjustments which produced its two major river systems that perhaps those races may have developed simultaneously with this change in the earth's crust.

Race a. Flowers deep royal blue, raceme fairly compact; plants always scapose; follicle cluster ovate in outline, 10–13 mm. long; drainages of the Gila River and Mogollon Mesa.

Race b. Flowers often lighter blue, raceme diffuse; plants not strongly scapose, often branching; follicle cluster oblong in outline, 18–20 mm. long; drainages of the Colorado River and Colorado Plateau.

From the western counties of Arizona and along its northern border come collections which variously combine these characters, however, and consequently for the present I only suggest these races. Still, almost any collection can be placed in one of these two categories, or conversely, it is possible upon the characteristic combination of tendencies to place a given collection geographically. The New Mexican and southern Arizona collections cited above are of the first race while the remaining constitute the paler-flowered "race b." The Newberry collection, which I have not seen, mentioned by Greene in the original description, is doubtless "race b." This is said to have come from "south of Diamond River," which is probably the place of that name in the Grand Canyon country described by Lemmon (Overland Monthly **12:** 253 of ser. 2. 1888).

Regarding the poisonous properties of this species, Miss Eastwood remarks that she has seen in the vicinity of Mancos, southwestern Colorado, four or five cattle lying together in a field, bloated as the goat-skin water jugs of Palestine.

2. DELPHINIUM AMABILE Tidestrom, Contr. U. S. Nat. Herb. **25:** 207. 1925.

Stout upright perennial, simple or branching from base, frequently hollow, 20–40 (or 90) cm. tall, arising from a short thickened rootcrown upon a few strong deep-seated rhizomatous roots clothed by persistent fibrous leaf bases; herbage often reduced and inconspicuous, pale green, variously hirsute-pubescent to glabrous and glaucous but never with a close-knit pubescence; leaves prevailingly on only lower half of stem (or evenly cauline or wholly basal), long petioled, deltoid in outline, angulately divided to the base into usually 3 or 5 cuneate divisions, these again cleft into linear early infolded lobes; racemes oblong, compact but not crowded, 8–16 (or 30) flowered, flowers 20–25 (seldom only 16) mm. long, on stout pedicels, the sepals lance-oblong, rather obtuse, often puckered or crimped at the tip, averaging 8–12 mm. long, not concolorous but variously light blue (clear sky-blue only in ssp. *apachensis* and dark blue-purple in some montane races), the upper petals merely notched, whitish, the lower petals bluish, the claw sometimes thinly pubescent with short glandular hairs, the blades with sinuses 1.5–2.5 mm. deep, a little less than half their length, usually open, often villous with curling white hairs; follicles nearly straight, commonly with divergent cusps, finely puberulent but shining, 8–14 (or 21) mm. long; seeds almost black, 2–4 mm. long, the coat a cocoon-like clear-white papery pellicle, deeply impressed at distal end and ample at the angles.

Authors have treated the common *Delphinium* of the Great Basin as *D. amabile*, but that it represents the same species as the plant of the Mohave Desert has not been suggested, except by inference in synonomy. S. B. Parish has outlined (1930, 487) the relation of the Mohave Desert

to the Great Basin point by point. He says, "there are no natural obstacles to cut [the Mohave Desert] from the deserts of southern Nevada and Utah, parts of the Great Basin, whose climatic conditions are like its own, and of which it may be justly considered a part." The true cause for the chorologic (in Rübel sense) diversity of the Mohave and Colorado deserts was also suggested by Parish to rest in the topography of the deserts themselves. Thus the Mohavan area is a complex of several basins, resulting from Pleistocene lakes for the most part, while the Colorado Desert is derivative from the single fairly uniform Cahuilla Basin and its catchment area. Apparently there have been developed within many of these Mohavan basins local races of *Delphinium amabile*, distinguishable by color shades, flower size, degree of stoutness and relative persistence of leaves at anthesis. The Manix Lake region northeast of Barstow shows a form of this species having unusually robust habit and loose racemes. On the other hand there occurs, as a geminate species, the essentially undifferentiated *Delphinium Parishii* on the Colorado Desert at lower elevations for the most part, the average elevation of the Mohave Desert being two-thousand feet whereas the Colorado Desert rests at an approximate sea-level elevation.

In *Delphinium amabile* there is possibly reached the ultimate in xerophytic habit among the North American species. When the aridity of this interior basin (including, accordingly, the Mohave Desert) is fully realized the reduction in vegetative parts to be noted in this species is less surprising. There are historically recorded drought periods of thirty-two months duration without registerable precipitation, with intervals between effective rains of even greater magnitude. Jaeger refers (1933, 133) to one such drought of 1909–1912 and its withering but not fatal effect on the Creosote Bush in the Bagdad region of the Mohave Desert. It is certainly the ability of such xerophilous types as *Delphinium amabile* to withstand protracted wilting and recover from it unimpaired upon the recurrence of the brief winter rains that have enabled these desert species to persist since the beginnings of Pleistocene time.

From rarer *Delphinium Parishii* of the Colorado Desert, *D. amabile* may be distinguished by its much stouter habit, pubescent generally reduced or inconspicuous leaves and darker blue flowers in dense racemes. Again, *D. amabile* favors typically rocky knolls and open desert mesas, ascending canyons of bordering mountains only on margins of its range, whereas *Delphinium Parishii* occurs only in canyons of mountains bordering the Colorado Desert on west or about washes issuing from them. This peculiarity in the distribution of *D. Parishii* is, I believe, associated with the fact that the Cahuilla Basin has been filled by water so recently that the spread of the species to the desert floor is imperceptibly slow.

KEY TO THE SUBSPECIES OF D. AMABILE

A. Sinuses of the lower petals 2–2.5 mm. deep, the lobes distally spreading; stems glabrous and glaucous (commonly bluish); racemes elongated, loose, 20–45 cm. long; south-central Arizona. 2a. *D. amabile apachensis*

AA. Sinuses of the lower petals 1.5–2 mm. deep, their lobes not conspicuously spreading; stems variously pubescent, less often glabrous; racemes moderately dense, little elongated; widespread in the southern Great Basin.

B. Flowers usually bright blue; sepals 8–14 mm. long; leaves withering at flowering time, mostly pubescent, their segments seldom mucronate, the margins early involute. 2b. *D. amabile typicum*

BB. Flowers pale (whitish or tinged with blue); sepals 6–7 mm. long; leaves evident at flowering time, mostly glabrous, their segments nipple-mucronate, plane to margins. 2c. *D. amabile pallidum*

2a. **Delphinium amabile** subsp. **apachensis** (Eastw.) comb. nov.

Delphinium apachensis Eastw., Proc. Calif. Acad. Sci. ser. 4. **20:** 142. 1931, based on *Eastwood* 17144 from road betw. Apache Lodge and Packard, Gila Co., Ariz. Type (Calif. Acad. Sci. Herb.) examined.

Smooth-stemmed perennial, often bluish below, more or less glaucous, firm but less stout than ssp. *typicum;* herbage glabrous or subglabrous, often somewhat fleshy; leaves both cauline and basal; raceme rather loose, full-flowered, 20–45 cm. long; flowers clear azure blue, the sinus of the lower petals 2–2.5 mm. deep, their lobes crimped, tending to spread giving a lacerate aspect to flower; follicles maximum size for species; seeds with pellicle ashy or discolored.

Collections examined: ARIZONA: Pinal Co.: San Tan Mts., *Harrison* 3533; Superstition Mt., *Peebles, Harrison & Kearney* 3895. Gila Co.: Roosevelt Dam, *Eastwood* 8665. Maricopa Co.: Apache Trail, *Eastwood* 6271; Salt River Mts., *Gillespie* 5578.

The full-flowered racemes of azure blue flowers suggest certain strains of cultivated Delphiniums for their beauty. The sepals, contrary to original description, are 9–12×5 mm. (in type collection) and ovate. This is a segregate of fairly sharp distinction which may be distinguished from the typical plant of the deserts to north and west by the remarkably deep petal sinuses. The plant tends to hold its leaves longer through the flowering period than ssp. *typicum.*

2b. **Delphinium amabile** subsp. **typicum** nom. nov.

Delphinium amabile Tidestrom, Contr. U. S. Nat. Herb. **25:** 207. 1925, based on following homonym:

D. coelestinum Rydb., Bull. Torr. Club **39:** 320. 1912, based on *Edward Palmer* "11" from "southern Utah," 1877. Type (Columbia Univ. Herb. at N.Y. Bot. Gard.) examined. From a ms. list of his collections of year 1877, made out by Dr. Sereno Watson and available at Gray Herba-

rium, it will be noted that no. 11 is "*Aconitum nasutum*" whereas no. 10 is "*Delphinium azureum*" from "St. G." This is St. George, Utah, and may be therefore known as the type locality. An isotype (U. S. Nat. Herb. 2009) examined where the label is more legible shows this correction to be borne out. The paratype, an Arizona specimen, *Palmer* 3, 1876, also represents this species. (Not *D. coelestinum* Franchet, 1894.)

D. azureum Michx. var. *vimineum* [(Don) Gray misapplied by] Coville, Contr. U. S. Nat. Herb. **4:** 57. 1893. as to Argus Mts. (*Coville & Funston* 737) which is by examination exactly this ssp.

D. Parishii [Gray misapplied in part by] Davis, Minn. Stud. Bot. **2[4]:** 441. 1900; Jepson. Fl. Calif. **1:** 526. 1915; Davids. & Moxley, Fl. S. Calif. 142. 1923; Wilde, Cornell Univ. Agric. Exp. Sta. Bull. 519: 64. 1931.

D. scaposum [Greene misapplied by] Brandegee, Zoe **5:** 148. 1903 as to plants of Providence Mts., Calif.

D. mohavense Parish ex Jepson, pro synon., Fl. Calif. **1:** 526. 1915.

Erect, typically stout rigid perennial 20–50 cm. tall, stems greenish or bluish above and pallid or white below, more often pubescent, sometimes strongly hirsute; leaves rather inconspicuous, reduced upwards and all early withering or involute; raceme more or less compact (in plants from vicinity of Barstow often loose), flowers light blue (in plants from Mono and Inyo counties and montane S. Calif. dark blue), sepals oval, plane, not recurved at tip, commonly with median band of pubescence, spur 8–12 mm. long, curving or straight, acute or acutish; pellicle of seeds clear white.

Representative material: UTAH: Washington Co.: betw. St. George and Beaverdam Mts., *Tidestrom* 9306; La Verken, *Jones* 5196a. Utah Co.: Goshen *Jones* in 1880. NEVADA: White Pine Co.: Muncy, *Jones* in 1906. Mineral Co.: Mt. Grant, *Heller* in 1913. Nye Co.: Rhyolite, *Shockley* 68. Clark Co.: St. Thomas (12 mi. s.), *Tidestrom* 9084; Moapa, *Kennedy* 1104; Good Sprs., *K. Brandegee* in 1915; Logan, *Kennedy* in 1909; Kyle Canyon, Charleston Mts., *Jaeger* in 1926. ARIZONA: Mohave Co.: Hualpai Mts., *Braem* in 1927; Franconia, *Jones* in 1903. Coconino Co.: Grand Canyon, *Lemmon* in 1884. Maricopa Co.: Wickenberg, *Jones* in 1903. Pima Co.: Vail (15 mi. se.), *Fosberg* 7942. CALIFORNIA: Mono Co.: Black Canyon, White Mts., *Duran* 527; Sherwin Grade, *Feudge* 142. Inyo Co.: Red Hill west of Bishop, *Heller* 8247; Shepherds Canyon, Argus Mts., *Coville & Funston* 737; Pleasant Canyon, Panamint Mts., *Hall & Chandler* 6968; Lee Well, Nelson Range, *Hall & Chandler* 7136; Black Mts., Death Valley, *Jaeger* in 1927. Kern Co.: Willow Sprs., *Munz* 10036; Cameron, *Feudge* 142. Ventura Co.: Frazier Borax Mine, *Abrams & McGregor* 209. Los Angeles Co.: Kings Canyon, Liebre Mts., *Dudley &*

Lamb 4350; Mt. Pacifico, San Gabriel Mts., *Peirson* 8441; Lytle Creek Canyon, *Hall* 1462. San Bernardino Co.: Kramer, Mohave Desert, *Parish* 9710; Victorville, *Spencer* 346; Fremonts Pk., *Hall & Chandler* 6860; Providence Mts., *Cooper* in 1861 (small flowered), *T. Brandegee* in 1902, *Munz, Johnston & Harwood* 4128 and *Hoffmann* in 1930 (all typical). Riverside Co.: Cottonwood Sprs., *Pierson* 7897.

Typical *Delphinium amabile* (here designated merely for easy reference as ssp. *typicum*) ranges from the open deserts and rocky hillsides of the desert ranges to the bordering mountains and ascends their slopes, through the piñon belt, to at least 7400 feet at the fringes of the Transition and Canadian zones. The most characteristic feature is the whole rigid aspect of the plant—stem, petioles and pedicels. The expanded (green) blades of the leaves in sterile plants are pubescent with white hairs only along veins and midrib or ciliate. But on withering the leaves (now colorless or brownish) show white spreading hairs up to 1 mm. in length, flat and as seen with binocular suggestive of shredded coconut, as covering the whole blade which has now become involute. Sometimes hirsute- and nearly glabrous-leaved plants occur in the same colony however; any correlation between this distinctive growth form in the genus and this type of pubescence is therefore impossible to draw.

There are two montane races of this subspecies which differ in such noticeable respects from the typical plant of the Sonoran deserts below that I am characterizing them here. They occupy two isolated areas in Southern California.

Race a. Habit taller (to 90 cm. high!), virgate; flowers usually dark, colored, smaller, more numerous, in often elongated subspicate racemes. North side of San Bernardino Mts. in Bear Valley region: Big Bear Lake, *Davidson* 2199, *Parish* 3781, *Jones* in 1900 and *J. T. Howell* 2748 from "open forest" on north shore. Also at Baldwin Lake, *Hilend* 469 and *Peirson* 10675, in Holcomb Valley, *Munz* 10659 (referred to *D. Parishii* var. *pallidum* by Munz, Bull. S. Calif. Acad. Sci. **31**: 61) and at Cactus Flat in Cushenbury Canyon, 6000 ft., *Jones* 12 V 1926. This race was confused with *D. recurvatum* Greene by Davidson (Muhl. **4**: 34). I am of the opinion that this race is clearly related to *D. amabile* however. There is pressing need for field study here. Though I have collected in the Bear Valley region during four summers I have not encountered this *Delphinium*. Presumably it occurs as either isolated plants or in small colonies.

Race b. Habit from strictly scapose to scarcely at all scapose; herbage moderately pubescent to strongly hirsute; inflorescence loosely racemose (racemes 20–40 cm. long), at times branching below to form secondary racemes (15–20 cm. long); flower color inconstant, various shades of light blue to pink purplish, petals often contrastingly snow-white. Component of variable populations about Mt. Pinos, Ventura County, as Cuddy Valley, *Dudley &*

Lamb 4515 and *Epling & Dunn* 27 VI 1931 and "road to saw-mill," *Dudley & Lamb* 4605. It is to be noted that ssp. *pallidum* occurs in this same area. This is the perplexing form referred to by Jepson (Fl. Calif. 1: 525) under *Delphinium hesperium* var. *cuyamacae* (Abrams) Jepson with the words "perhaps also on Mt. Pinos." Its singular dark-flowered forms bear striking resemblance to *Delphinium Parryi* Gray of cismontane Southern California. The lax racemes are at once a noticeable feature of this race. As with "race a" a fortified explanation of this race is at present impossible by virtue of several minor points of interdisagreement among the available collections.

2c. **Delphinum amabile** subsp. **pallidum** (Munz) comb. nov.

D. Parishii Gray var. *pallidum* Munz, Bull. S. Calif. Acad. Sci. **31**: 61. 1932, based on *Munz* 6954 from Seymour Creek, Mt. Pinos, 10 VI 1923. Type (Pomona College Herb. 20509) examined.

? *D. Hanseni* (Greene) Greene var. *kernense* Davidson, Muhl. **4**:37. 1908, based on *Hasse & Davidson* 1703 from "dry sunny slope," Mt. Cummings, Tehachapi Mts., 10 VI 1907. Type (Los Angeles Mus. Herb. 3976) examined. This represents a form with shaggy white-pilose leaves and lower petals scarcely emarginate but flower size and color are exactly this ssp. Lacking the critical seeds this Tehachapan element must await further field study and collections; it seems unlikely, however, that it is related to *D. Hanseni*.

Stout simple-stemmed perennial, commonly 20–35 cm. high; leaves mostly basal, generally glabrous, subsucculent, the segments nipple-mucronate; raceme fairly dense, flowers whitish or tinged with blue, the sepals short and obtuse, somewhat recurved at tips, thus giving a blunt aspect to flower, 6–7 mm. long, evenly pubescent over back with short white hairs, spur short, 7–10 mm. long, blunt at tip.

Other collections examined: Cuddy Valley, Mt. Pinos, *Epling & Dunn* 8 VI 1931, *Dudley & Lamb* 4527; Seymour Creek, *Peirson* 3589 ("mostly in open"); Goodenough Mdw., *Dudley & Lamb* 4722.

This subspecies occupies the Mt. Pinos region of California—an area of perennial interest to the biologist for its endemism and mixed distributional affinities. This *Delphinium* is characterized, as pointed out by Munz, by its pale flowers and short sepals and spur.

3. DELPHINIUM SUBGLOBOSUM Wiggins.

Delphinium subglobosum Wiggins, Contr. Dudley Herb. **1**: 99. pl. 7. 1929, based on *Wiggins* 2003 from "open grassy slope near Banner, about 5 miles below Julian," San Diego Co., 20 III 1926. Type (Dudley Herb. 163266) examined.

D. Parryi Gray var. *subglobosum* Munz, Bull. S. Calif. Acad. **31**: 61. 1932, in part, excluding "San Felipe" and "Campbells" citations.

Strict, erect, simple or few-branched perennial from slender woody rootstock of few deep-seated fibrous roots; stem glabrous and glaucous or puberulent below, washed blue or purplish, 45–60 cm. high; leaves rather numerous, chiefly basal, long-petioled, blades roundish, the few principal divisions again divided into several strictly linear obtuse or apiculate segments, the petioles (esp. distally) and blades hirsute or hirsutulose with spreading white curling hairs; raceme short (10–18 cm. long), at length rather interrupted but not loose, about 10-flowered, the flowers variable in color, usually dark blue or purplish, stout-pedicelled, the sepals oval, obtuse, 8–11 mm. long, hirsutulose when young, the pubescence persisting as a median band; follicle short, subglobose, truncate at summit, 6–10 mm. long, straw-colored (not greenish at maturity), the cusp short; seeds 1.5–2 mm. long, the pellicle more or less ample, clear white.

Other collections examined: SAN DIEGO COUNTY: Montezuma Valley, *Jaeger* 26 V 1926 (singular habit and strongly hirsute); Jacumba, near International Boundary, *Ferris & Bacigalupi* 8222.

Grassy benches and rock pockets of canyons draining into the Colorado Desert, along its western margin, San Diego Co., California. Apparently occurs only at somewhat higher elevations than *Delphinium collinum* which occupies the same region and differs from that species in having pubescent to hirsute leaves, shorter more compact raceme and subglobose blunter follicles.

The position of *Delphinium subglobosum* phylogenetically cannot at present be ventured. From both *collinum* of the desert canyons at lower elevations and from *Parryi* of the cismontane foothills which in this region are broken up to admit the coastal flora to encroach upon the desert associations, *Delphinium subglobosum* seems distinct. The seed character definitely separates it from *D. Parryi* of the coast which belongs to another series of the Subsection Subscaposa. *D. subglobosum* carries the pellicled-type seed of the present series Pelligerae. The collections available are discontinuous geographically and frequently lack mature seeds so do not admit of any assured understanding of the species. Wiggins, who knows the plant best from field experience in the region, states its range, "along the eastern slope of the Laguna and Cuyamaca mountains of San Diego County in the Upper Sonoran Zone, in the *Sabina* [*Juniperus*] *californica* belt" (Flora San Diego County **1:** 280–281. 1929. Unpublished thesis, Stanford University).

4. **Delphinium collinum** Ewan sp. nov.

D. Parryi Gray var. *subglobosum* Munz, Bull. S. Calif. Acad. Sci. **31:** 61. 1932, in part, as to "San Felipe" and "Campbells" citations.

Slender, erect perennial, 30–70 cm. high, from a slender woody-fibrous rootstock; stem simple or as often branching, commonly bluish, glabrous and glaucous; leaves predominantly basal, of 3 principal sublinear divisions these again divided into few to several shorter, linear, subfiliform, mucronulate teeth, the cauline reduced or inconspicuous, puberulent when young, glabrous in age or nearly so, petioles dilated at base, the lower 8–10 cm. long; racemes elongate, open or early interrupted, the lowermost branches distant; flowers on ascending or spreading pedicels 8–20 mm. long, their sepals dark blue or purplish but bright, oval, rounded or barely acute, 9–12 mm. long, essentially glabrous, the uppermost and spur with fine puberulence or with finely pubescent median band, the upper petals light blue or pallid, the lower petals emarginate (sinus 1 mm. deep), blue-purple, moderately white-villous; follicles oblong, venulose, 12–14 (rarely 10 or 15) mm. long, with prominent cusp, often darker; seeds 2–2.5 mm. long, the white crepe pellicle commonly impressed on the faces to form irregular wing-like angles.

Herba perennis caulibus strictis gracilibus, 30–70 cm. altis, e radice tenui lignosa, simplicibus vel saepe ramosis, caesiis, glabris glaucisque; foliis imprimis ad caulis basim confertis, tripartitibus, segmentis sublinearibus divisis dentatis brevioribus linearis ac subfiliformis, mucronulatis; caulibus inconspicuis, omnibus primum puberulentis deinde glabris, inferiorum petiolis 8–10 vel 12 cm. longis; racemis elongatis atque patentibus, ramis inferioribus remotis divaricatis; floribus pedicellis divaricatis vel arcuatis, 8–20 mm. longis, elatis, sepalis atro-caeruleis tamen lucidis, ovalibus, obtusis vel subacutis, 9–12 mm. longis, extus glabris vel ad medium villosulis, petalis superioribus azureis vel fere albidis, inferioribus emarginatis, subniger, albo-villosis; folliculis oblongibus, 12–14 (rarissime 10 vel 15) mm. longis, cuspide prominentiore ornatis, venulosis, seminibus 2–2.5 mm. longis, integumentis niveis saepe impressis irregulariter angulatis similiter alatis.

TYPE: Ridge betw. Campbells Ranch and Mason Valley, San Diego County, Calif., *Epling & Robison* 4 IV 1932. (Univ. Calif. at Los Angeles Herb.) Isotypes to be distributed.

Rocky slopes of canyon spurs and ridges, associated with *Encelia farinosa*, *Krameria canescens*, *Fouquieria* and *Fagonia* of desert-scrub, along western margin of the Colorado Desert of San Diego County.

Other collections examined: San Felipe Creek, *Pierson* 7740; jct. of Grapevine and San Felipe creeks, *Jepson* 8789; San Felipe Hill, *Jones* 19 IV 1906; Yaqui Well, *Eastwood* 2647; Hellhole Cañon, *Epling & Robison* 5 IV 1932; head of Sentenac Canyon near San Felipe, *Epling & Robison* 5 IV 1932; Campbell Ranch, *Munz & Hitchcock* 12082; Mason Valley, *Duran* 3204: Oriflamme Canyon, *Epling et al.* 22 VI 1932.

The place occupied by *Delphinium collinum* in the present series can best be summarized by the chart given below, showing its morphological relationship to its three nearest geographic allies. *Delphinium Parryi* is a

member of another series characterized by distinctly winged seeds. Although the characters here given are stated decisively a rather wide latitude for variation must be granted in this genus. The notes on flower color have been drawn up wholly from herbarium material on the basis of Ridgway's Nomenclature of Colors, 1886, since, under ordinary care in drying, *Delphinium* specimens keep their natural colors and such notes will therefore have workable uniformity among general collections.

SPECIES	STEMS	LEAVES	SEPAL COLOR	MATURE FOLLICLES
collinum	glabrous	glabrous to puberulent	hyacinth blue or smalt blue	oblong, microscopically puberulent
subglobosum	glabrous	hirsute or hirsutulose	hyacinth blue	subglobose, lightly hairy
parishii	glabrous	glabrous	campanula blue	oblong, wholly glabrous or subglabrous
parryi	thinly puberulent to ashy-hirsutulose	thinly pubescent to hirsutulose	cyanine blue to plum purple	oblong, evenly hairy with fine appressed puberulence (rarely glabrous)

As suggested early in this paper *Delphinium collinum* may have arisen by hybridization between *Parishii* and *subglobosum* following the establishment of *Parishii* at approximately its present position in the western arm of the Colorado Desert. By reference to the above chart its morphological position will be seen to be exactly intermediate between these species, for it combines the glabrous leaves and follicle shape of *Parishii* with flower color and leaf contour of *subglobosum*.

5. DELPHINIUM PARISHII Gray

Delphinium Parishii Gray, Bot. Gaz. **12:** 53. 1887, pro parte, based on *S. B. & W. F. Parish* 1222 from Agua Caliente (now Palm Springs, Riverside Co.) but more exactly from Tahquitz Canyon (or West Canyon) above Palm Springs (cf. Muhl. **3:** 125), Colorado Desert, IV 1882. Type (Gray Herb.) photograph and isotypes examined. Excluding reference to "adjacent Lower California" based on *C. R. Orcutt* from "Mts. of N. Lower Calif." 5 VII 1884; this collection annotated in customary manner by Gray as "*D. Parishii.*" From photograph and immature seed specimens kindly provided by Mr. C. A. Weatherby, I can speak only negatively at present, that is, that the Orcutt collection mentioned by Gray (i.e. paratype) is not *D. Parishii*. Its exact relationships are uncertain. I have seen another collection from 40 miles west of Mexicali, 4000 ft., Baja Calif., *Munz* 9595, with which the Orcutt collection favorably agrees. It possibly represents a southern extension of *D. subglobosum* Wiggins.

D. Parishii [Gray misapplied in part by] Davis, Minn. Bot. Stud. **2**[1]**:**

441. 1900; Jepson, Fl. Calif. **1:** 526. 1915, excluding all cited colls. except *Parish* 6074; Wilde, Cornell Univ. Agric. Exp. Sta. Bull. 519: 64. 1931.

Erect or somewhat lax slender perennial, simple or divergently branched, 12–36 cm. high, from slender, fibrous cord-like rootstock; herbage glabrous, often glaucous; lower leaves ample, glabrous or with a few scattered hairs, blades broadly cordate or roundish, 3–8 cm. broad, palmately divided into 3 primary cuneate divisions, each irregularly cleft into 2 or 3 broad oblong rounded (seldom acuminate) but mucronate lobes, petioles sparingly ciliate, 2–10 (or 15) cm. long; upper leaves trifid to midrib into narrowly lanceolate to linear-acuminate divisions, glabrous, long-petioled (.5 to 5 or 10 cm. long); raceme open, loose, few-flowered, 8–30 cm. long, or rarely a loose panicle up to 60 cm. with spreading branches bearing 2–6 flowers at their summits; flowers light or azure blue, pedicels spreading (12–24 mm. long), sepals ovate, glabrate, 8–11 (or 13) mm. long, little surpassing the petals, two-thirds the length of the spur; follicles oblong or ovate, 11–13 mm. long, the cusp prominent; seed 1–2 mm. long, the loose white-crepe pellicle copious.

Collections examined: RIVERSIDE COUNTY: Snow Creek, *W. D. Baker* in 1930; Murray Canyon, *Peirson* 2902; mouth of Tahquitz Canyon, *Johansen & Ewan* 7094; vicinity of Palm Springs, *Parish* 6074 and many collectors; Palm Canyon, *Johnston* in 1917; Deep Canyon, *Clary* 821.

Localized about the western arm of Colorado Desert, California, it favors the banks of streams and gravel benches of canyons draining into the Cahuilla Basin, ascending at least to 2500 feet elevation.

When reviewing the Southern California species, Davidson expressed difficulty in finding agreement between the specimens then before him and Gray's original description (cf. Muhl. **4:** 36), unaware that he was dealing in this instance with a highly restricted species erroneously amplified by authors to include the dissimilar Mohave Desert plant. However, he left the matter with the view that only the Palm Springs' collections could justly be taken as *Delphinium Parishii*—which, I believe, is the correct decision.

Gray characterized *D. Parishii* as "rigid-stemmed," a situation which disturbed me as unjustified for the species, especially when compared with the truly stout *Delphinium amabile* of the Mohave Desert. His character was taken from the Parish type sheet which shows the leaf-blades almost wholly lacking, decapitated as it were, with only the long petioles stiffly remaining. As the species is thus represented it may be rightly considered "rigid-stemmed"—a leafless gaunt plant and therefore distinctly atypical for this *Delphinium* which is leafy in anthesis with the blades not withered but expanded, green and conspicuous. Upon finally suspecting the possible traumatic nature of this condition I consulted Dr.

R. B. Cowles of the University of California at Los Angeles, a zoologist who has given particular attention to reptiles. He at once suggested that the condition might be due to the browsing activities of the native vegetarian chuckwallas. And this is likely the fate of the leaf-blades of the type specimen! Camp relates finding a chuckwalla in a *Larrea* bush "from which most of the leaves had been stripped" and the remains of *Franseria* and *Euphorbia* in the stomachs of others (Univ. Calif. Publ. Zool. **12**: 524. 1916). It may be concluded then that the type collection (for the isotypes examined show the same condition) of *Delphinium Parishii* is not typical of that species.

The "All Saints Bay" (i.e. Todos Santos Bay) record for this *Delphinium* (Syn. Fl. **1**: 48. 1895) is rather *Delphinium Parryi* Gray, precisely the maritime form "var. *maritimum* Davidson" (Muhl. **4**: 35). This collection was made, not by Orcutt, the logical inference from the citation, but by (Miss) Fanny E. Fish in May 1882, at that time a resident of Sauzal, Baja California. This collection, a photograph and seeds of which have been available to me, is designated by Gray as *Parishii* in the manner in which he indicated type-basis materials and doubtless contributed to his concept of this species.

UNIVERSITY OF CALIFORNIA
BERKELEY

Literature cited

Brewer, W. H. and Watson, Sereno. 1876. [*Delphinium* in] Botany of California. **1**: 10. (Same pagination in ed. 2, 1880.)

Davidson, A. 1908. Delphinii of Southern California. Muhl. **4**: 33–37.

Davis, K. C. 1900. Native and garden delphiniums of North America. Minn. Bot. Studies **2**[4]: 431–457.

Eastwood, A. 1901. Notes on California species of *Delphinium*. Bull. Torrey Club **28**: 667.

Gray, A. 1887. *Delphinium*, an attempt to distinguish the North American species. Bot. Gaz. **12**: 49–54.

————. 1895. [*Delphinium* in] Synopt. Flora N. Am. **1**: 45–52. With additions by B. L. Robinson.

Greene, E. L. 1892. Flora Franciscana 303.

Huth, E. 1895. Monographie der Gattung *Delphinium*. Engler, Jahrb. **20**: 322–499.

Jaeger, E. C. 1933. California deserts. 207 pp. Stanford Univ. Press.

Jepson, W. L. 1915. [*Delphinium* in] Flora of California **1**: 518–527.

Jones, M. E. 1895. Proc. Calif. Acad. Sci. ser. 2, **5**: 618.

Parish, S. B. 1930. Vegetation of the Mohave and Colorado deserts of Southern California. Ecology **11**: 481–499, with 9 figs.

Rydberg, P. A. 1912. Bull. Torrey Club **39**: 320.

Wilde, E. I. 1931. Studies of the genus *Delphinium*. Cornell Univ. Agric. Exp. Sta. Bull. **519**. 107 pp.

The optical properties of some natural gums and resins

A. E. Alexander

Through the courtesy of Dr. Charles L. Mantell and the Gum Importers Association of America, samples of the commoner natural resins used in industry were forwarded the writer for optical study. Appreciation is also extended to Mr. R. A. Young of the Bureau of Plant Industry for kindly straightening out the confusion existing between the trade or locality name and the generic and specific designation of these same commercial terms.

Gums are amorphous and under polarized light such substances react isotropically. They consequently possess only one index of refraction.

Special immersion oils of known refractive index were used and the Becke test employed to obtain the desired optical data. The index of refraction of several of these natural resins, as determined, is:

CW Kauri	1.546
#3 Pale Kauri	1.546
#3 Brown Kauri	1.544
Pale East India	1.543
Zanzibar	1.542
Rosin	1.542
Ivory Congo	1.541
Dark Congo	1.541
Black East India	1.541
Benguela	1.541
Pontianak	1.540
Loba B Manila	1.539
Hard Manila	1.539
Bold Dammar	1.538
Batu (Batoe)	1.538
Tacamahac	1.538
Ghatti	1.528
Senegal	1.526
Gutta Percha	1.528
Tragacanth	1.510 (mean index)

The botanist and the manufacturer using natural gums or resins might be interested in the following data correlating trade or locality names with scientific names and the place or places where these particular trees or shrubs occur. No one textbook so far as the writer knows gives this information in condensed form.

Trade or locality name	*Botanical nomenclature*	*Where found*
Accra copal	Paradaniella Oliveri	Nigeria
Accroides	From various species of Xanthorrhoea	Australia, Tasmania
Almadina	Euphorbia rhipsaloides	Tropical Africa

Trade or locality name	*Botanical nomenclature*	*Where found*
Amber	Pinites succinifer	Baltic Coast
Animi	Hymenaea courbaril	West Indies, Brazil
Arabic	Acacia senegal	Sudan
Balata	Mimusops balata	Venezuela, Guianas
Black Boy	Xanthorrhoea hastilis	Australia
Brazilian	From various species of Hymenaea	Brazil
Chicle	Achras sapota	
	Vitellaria mammosa	W. I., Mex., Cent. Am.
Congo Red	Landolphia florida	Tropical Africa
Coumar	Coumarouna odorata	Tropical America
Damar (Dammar)	Vateria indica, from the genera: Hopea, Shorea, Balanocarpus, Vateria	Malay, Sumatra, E. I., Netherlands
Elastica	Castilla elastica	
	Manihot glaziovii	
	Ficus elastica	Cent. and S. Am., Asia
Elemi	Canarium luzonicum	
	Protium icicariba	
	Elaphrium elemiferum	Africa, Brazil, Mexico
Frankincense	From various species of Boswellia	Northern Africa
Gamboge	Garcinia morella	Siam
Grass tree	Xanthorrhoea hastilis	Australia, Tasmania
Guaiac	Guaiacum officinale, G. sanctum	Tropical America
Gutta percha	Palaquim gutta	Malaya
Indian	Vateria indica	India
Karaya	Sterculia urens	East Indies
Kauri	Agathis australis	Australia
Macassar	Cananga odorata	Southern India, Java, Philippines, Malay
Manila	Agathis dammara	Australia
Mastic	Pistacia lentiscus	Chios
Myrrh	Balsamea myrrha	India, Arabia, Somali
Sandarac	From various species of Callitris	Australia, N. W. Afr.
Sierre Leone	Copaifera guibourtiana	West Africa
Sumatra (Dragon's blood)	Daemonorops Draco	
	Dracaena cinnabari, D. Draco	Sumatra, Borneo
Tacamahac	Calophyllum tacamahaca	
	Icica heptaphyllum	
	Elaphyrum tomentosum	
	Calophyllum inophyllum	W. I., E. I.
Tragacanth	Astragalus spp.	Turkey, Persia
Zanzibar	Trachylobium verrucosum	East Africa

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Notes on the genera Basistemon Turcz., Hassleropsis Chod., and Saccanthus Herzog

HAROLD N. MOLDENKE

In 1916 Theodor Herzog proposed the genus *Saccanthus*[1] as a new genus of the *Verbenaceae*. On his original collection labels he indicated that his first impression was that the plants might belong in the *Solanaceae*, but when he published the genus he placed it definitely and without question in the *Verbenaceae*, even going so far as to assert that it was closely related to *Rhaphithamnus* Miers. The generic name, *Saccanthus*, he derived from the very saccate corollas, which, he admitted, rendered the genus most unique in the *Verbenaceae* and certainly very distinct from *Rhaphithamnus*. Herzog's material was all from Bolivia.

In the course of my monographic studies of the New World and cultivated *Verbenaceae* I borrowed all available herbarium material of *Saccanthus*, including the original types and three isotypes of each of Herzog's two species, *S. silvaticus* and *S. violaceus*. Study of this material has revealed the very interesting fact that the genus is not verbenaceous, but that it is a member of the *Scrophulariaceae*, series *Antirrhinoideae*, tribe *Hemimerideae*, according to the classification of R. von Wettstein in Engler and Prantl's "Die Natürlichen Pflanzenfamilien," related to the genus *Angelonia* H. & B.

Further researches in the library and in the herbarium have brought to light the genus *Hassleropsis*, proposed in the *Scrophulariaceae* by R. H. Chodat in 1904[2] on the basis of a Hassler collection from Paraguay. Chodat proposed only one species in *Hassleropsis*, *H. spinosa*, of which, fortunately, type material was available to me in the herbarium at Kew. *Saccanthus violaceus* Herzog and *Hassleropsis spinosa* Chod. are conspecific.

In 1863 Turczaninow published the genus *Basistemon*[3] as a new genus in the *Verbenaceae*. In 1876 Bentham and Hooker f.[4] transferred *Basistemon* Turcz. from the *Verbenaceae* to the *Scrophulariaceae*, giving as the reason for the transfer the position of the ovules and the type of inflorescence. Wettstein, who monographed the *Scrophulariaceae* for Engler and Prantl's "Die Natürlichen Pflanzenfamilien," placed *Basistemon* in the series *Antirrhinoideae*, tribe *Cheloneae*, and stated[5] that it was closely related to or even synonymous with *Brandisia* Hook. & Thoms. The

[1] Meded. Rijks Herb. Leid. 29: 47.
[2] Bull. Herb. Boiss. ser. 2, 4: 285.
[3] Bull. Soc. Imp. Nat. Mosc. 36[2]: 214.
[4] Gen. Pl. 2: 1244 (incorrectly cited by Baehni and Macbride as "1826").
[5] Engl. & Prantl, Nat. Pflanzenfam. 4[3b]: 66. 1897.

genus has remained in this more or less doubtful status in the *Scrophulariaceae* for 37 years, until, in 1934, Charles Baehni and J. Francis Macbride published a note[6] establishing the fact that *Saccanthus* Herzog and *Basistemon* Turcz. are congeneric. Baehni and Macbride, however, missed the fact that *Hassleropsis* Chod. is also a generic synonym, and they are entirely in error in their proposal to shift *Basistemon* back into the *Verbenaceae*. Even though both *Basistemon* and *Saccanthus* were originally proposed in the *Verbenaceae*, my own studies of the type collections of all the known species of this genus (including those of *Saccanthus* and *Hassleropsis*) have convinced me that Bentham and Hooker f. were quite right in transferring the genus to the *Scrophulariaceae*. The inflorescence of certain verbenaceous genera is similarly reduced, it is true, and "pendant ovules are not in contradiction to the diagnosis of the *Verbenaceae*" according to Baehni and Macbride. Notwithstanding this, the genus *Basistemon* is definitely scrophulariaceous. No known genus of *Verbenaceae* possesses the conspicuously saccate corollas which it exhibits, although a slight inflation of the lower part of the corolla-tube is noticeable in *Cornutia* and in some other verbenaceous genera. Aside from that, however, the very distinctly axile placentation, numerous ovules, and capsular fruit found in *Basistemon*, definitely exclude it from the *Verbenaceae*, and, along with the plainly 2-celled ovaries, indicate its true position in the *Scrophulariaceae*, in which family woody genera are not at all common. It belongs definitely in the series *Antirrhinoideae* and the tribe *Hemimerideae*, not in the tribe *Cheloneae* as Wettstein supposed. In *Cheloneae* the flowers are neither spurred nor saccate, while in the *Antirrhineae* and *Hemimerideae* they are either spurred or saccate at the base. In the *Antirrhineae*, however, the corolla has a definite tube, which is lacking in the *Hemimerideae*. The plainly saccate tubeless corollas of *Basistemon* therefore clearly indicate its position in the family.

The following notes concerning the five known species of *Basistemon* are worth recording:

(1) BASISTEMON BOGOTENSIS Turcz., Bull. Soc. Imp. Nat. Mosc. **36**[2]: 214. 1863. This is the type species of the genus. The type was collected by Jean Jules Linden (*no. 812*) near Pandi, Cundinamarca, Colombia, in 1842, at an altitude of 2400 feet. An isotype is deposited in the herbarium at Kew and a fragment of an isotype in the Britton Herbarium at the New York Botanical Garden. The specific name was spelled "*bogotense*" by Turczaninow, but under Article 72 of the International Rules (1930) all generic names terminating in the suffix "*-stemon*" must be considered

[6] Candollea **5**: 345.

masculine; hence the spelling of Hooker f. and Jackson [Ind. Kew. **1:** 277. 1895] is here adopted.

(2) BASISTEMON PERUVIANUS Benth. & Hook. f. Gen. Pl. **2:** 1245 (1876) apud Hook. f. & Jacks. Ind. Kew. **1:** 277. 1895. *Russelia peruviana* Spruce ex Benth. & Hook. f. Gen. Pl. **2:** 1244, in syn. 1876. The type of this species was collected by Richard Spruce (*no. 4515*) near Tarapoto, San Martín, Peru, in October, 1856. The type and two isotypes are deposited in the herbarium at Kew and a fragment of the type in the Britton Herbarium at the New York Botanical Garden. The binomial, *Basistemon peruvianus*, was not validly published in the 1876 reference to which it is usually cited. In fact, it does not occur there at all, being merely suggested in the text. Spruce's cheironym, however, is given there and also a brief description of the plant. The binomial was apparently first validly published in the "Index Kewensis" in 1895 (although the specific name is there misspelled "*peruviana*"), the citation there given referring to the brief description of 1876 and therefore validating the binomial.

(3) BASISTEMON SILVATICUS (Herzog) Baehni & Macbr., Candollea **5:** 345. 1934. *Saccanthus silvaticus* Herzog, Meded. Rijks Herb. Leid. **29:** 47. 1916. The type of this species was collected by Theodor Herzog (*no. 1132*) at Villa Montes on the Río Pilcomayo, Chuquisaca, Bolivia, in November, 1910, and is deposited in the Rijks Herbarium at Leiden. Isotypes may be found in the herbaria at Berlin, Stockholm, and Vienna, and a fragment in the Britton Herbarium at New York. The species was also collected by Pearce (*s.n.*) along the Machuiapo, El Beni, Bolivia, in December, 1864, deposited in the herbarium at Kew. The specific name is misspelled "*silvaticum*" by Baehni and Macbride.

(4) **Basistemon spinosus** (Chod.) Moldenke, comb. nov.

Hassleropsis spinosa Chod., Bull. Herb. Boiss. ser. 2, **4:** 285. 1904. *Saccanthus violaceus* Herzog, Meded. Rijks Herb. Leid. **29:** 47. 1916. *Basistemon violaceum* (Herzog) Baehni & Macbr., Candollea **5:** 345. 1934. The type of this species, which is also the type of the genus *Hassleropsis* Chod., was collected by Emil Hassler (*no. 7350*) near Concepcion, Paraguay, in September, 1901, and is deposited at Geneva, with an isotype at Kew. The type of *Saccanthus violaceus* was collected by Theodor Herzog (*no. 1214*) at Charagua, Santa Cruz, Bolivia, in December, 1910, and is deposited at Leiden, with isotypes at Berlin, Stockholm, and Vienna, and a fragment at New York.

In *B. spinosus* the ovules are very numerous in each cell of the ovary, although the fruits examined seem to indicate that most of these ovules never mature, so that the fruits are mostly 1- or 2-seeded. The seeds are densely spiny throughout. In *B. silvaticus*, on the other hand, there seem

to be only 2 or 3 ovules in each cell of the ovary, but, again, axile in their attachment. The stigma in both species is very small and punctiform, mostly very indistinct. The ovary is ellipsoid when young, subglobose in age, glabrous, and slightly lobed. The capsules are 2-valved, but bear on their back several prominent ridges giving the appearance of a 4- or 5-celled capsule before it has opened. The style is persistent on the maturing fruit. In *B. spinosus* the 4 stamens are plainly didynamous, all inserted at the same level near the base of the gamopetalous portion of the corolla, but two plainly much longer than the other two. In *B. silvaticus* the stamens are almost equal in length. According to Herzog the color of the corolla in *B. silvaticus* is white, while in the other species it is violet.

Other differences that might be mentioned between *B. spinosus* and *B. silvaticus* are that in the former species the corolla-sac is densely glandular-pubescent throughout on the inner surface, the flowers are about 4 mm. in diameter, the calyx-lobes are acute (not at all subulate), and the leaves are usually only 1.5–2.5 cm. long and 4–9 mm. wide. In the latter species the corolla-sac is glandular only at its very base within, the flowers are about 6 mm. in diameter, the calyx-lobes are long-subulate, and the leaves are to 4 cm. long and 16 mm. wide. The foliage in the former species mostly blackens in drying and is borne on extremely abbreviated spur-like twigs, while in the latter species it does not blacken and the twigs are elongate.

The anther-connective in *Basistemon* is conspicuously thickened and dilated and assumes a sagittate form. As the pollen-grains mature, the connective spreads farther and farther apart, until, when the anther-sacs dehisce, they lie in practically a straight line at right angles to the filament. The line of dehiscence is a slit on the top of both thecae. The leaves are opposite in all the species. In a letter to the writer from Dr. F. W. Pennell this distinguished authority on the *Scrophulariaceae* expresses his agreement with the findings set forth in the present article and remarks that since the known species of this genus have come to light in such distant portions of South America, viz., Colombia, Peru, Bolivia, and Paraguay, it is very possible that we are just beginning to become acquainted with a considerable South American genus.

(5) **Basistemon Rusbyi** Moldenke, sp. nov.

Fruticulus; ramis ramulisque gracilibus acute tetragonis dense puberulis; nodis non spinosis; foliis sessilibus vel subsessilibus, laminis ovatis vel ovato-ellipticis membranaceis nitidis 1.3–5.5 cm. longis, 1–3.2 cm. latis, acutis vel brevissime acuminatis, margine minute serrulatis, ad basin rotundatis, supra glabris, subtus dense minuteque puberulis; inflorescentiis axillaribus, cymis 1–3-floris bracteolatis; pedicellis 4–6 mm. longis dense puberulis; calyce cam-

panulato 2–2.6 mm. longo glabrato, lobis 5 lanceolatis ad basin amplissimis, 0.7–2.3 mm. longis, ad basin 1.5–1.8 mm. latis, apiculatis costatis; corolla saccata, tubo obsoleto, folliculo ca. 5.2 mm. lato intus extraque glabro, limbo ca. 5.2 mm. lato, lobis intus parce glanduloso-pubescentibus extra glabris; staminibus 4, ca. 0.6 mm. supra basin corollae insertis, didynamis; filamentis complanatis glabris, 2 ca. 1.5 mm. longis, 2 ca. 2.6 mm. longis; thecis antherarum in linea recta divergentibus; stylo paullo exserto ca. 4.6 mm. longo; stigmate sub-2-lobato; ovario elliptico ca. 1 mm. longo et 0.6 mm. in diametro, 2-loculari, in quoque loculo 2 ovulis pendulis ad apicem medii dissepimenti insertis.

The type of this species was collected by Henry Hurd Rusby (*no. 1343*)—in whose honor it is named—at Reyes, El Beni, Bolivia, on October 26, 1921, at an altitude of 100 feet, and is deposited in the herbarium of the Royal Botanic Gardens at Kew, with an isotype and a fragment of the type in the Britton Herbarium at the New York Botanical Garden.

The following artificial key may be found useful in separating the five species discussed above:

1. Corolla-sac densely velutinous within.
   2. Corolla violet, its sac densely glandular-pubescent throughout within; flowers about 4 mm. in diameter; calyx-lobes acute; leaves usually only 1.5–2.5 cm. long and 4–9 mm. wide, mostly blackening in drying, borne on extremely abbreviated spur-like twigs ..... *B. spinosus.*
   2a. Corolla white, its sac glandular only at the base within; flowers about 6 mm. in diameter; calyx-lobes long-subulate; leaves to 4 cm. long and 16 mm. wide, not blackening in drying, borne on normal elongated twigs..... *B. silvaticus.*

1a. Corolla-sac glabrous both outside and within.
   3. Branches spiny; Colombia ..... *B. bogotensis.*
   3a. Branches not spiny; Peru and Bolivia.
      4. Leaves 1.3–5.5 cm. long, 1–3.2 cm. wide; Bolivia..... *B. Rusbyi.*
      4a. Leaves 5.7–14 cm. long, 2.3–8.1 cm. wide; Peru..... *B. peruvianus.*

THE HERBARIUM,
ROYAL BOTANIC GARDENS, KEW

Ephedra Coryi

E. L. Reed

(with two figures)

While on a collecting trip in the early part of July, 1934, the writer discovered an *Ephedra* closely resembling, in habit, *Equisetum arvense* in that it had, above ground, only green profusely-branched stems. A further study of it through the fruiting stages in the spring and early summer of 1935 warrants a description of it as an hitherto undescribed species.

Ephedra Coryi[1] sp. nov. Planta: frutex humilis erectis 1–5 dm. altus; ramis viridibus numerosus erectus 1–4 mm. in diametro; scalis ramulorum 2 ad quemque nodum; vagina facta 1–2 mm. longis; apicibus obtusis 1–2 mm. longis vel subulatis 4–10 mm. longis; amentis mascularis sessibilis vel in ramis brevibus 2–10 mm. longis; bracteis 5 gemini 2 mm. longis; lobis peranthi ad summum coniunctis; columna staminum 3 mm. minusive longis; antheris 6–8 sessibilis aut in filamentis brevis; amentis ovulatis terminalibus in ramis brevibus ½–4½ cm. longis; bracteis 4 gemini 5 mm. minusive longis; bacca rotunda sufflava carnosa esculenta 1.1 cm. minusive in diametro; seminibus 2 ovatis triangularibus exertis.

A slender stemmed, profusely-branched shrub 1–5 dm. high; branches erect, opposite; all above ground stems green, 4 mm. in diameter or less which arise from an upright underground stem whose origin is from a node of an extensive system of rhizomes; aerial stems all short-lived; scales 2 at each node (sometimes 3) connate at their bases forming a sheath 1–2 mm. long, their tips obtuse 1–2 mm. long or subulate 4–10 mm. long; staminate aments in pairs from the axils of the scales or on short branches of the season 2–10 mm. long, sometimes there are 3 staminate aments at the ends of these short stems, 1 terminal and 2 in the axils of its scales; bracts 5 pairs 2 mm. long; slightly united at their bases; perianth lobes united to their summits; anthers usually 8 sessile or the outer ones short stipitate; stamen column 3 mm. long; ovulate aments on the ends of short branches of the season, of 1 or 2 internodes, 0.5–4.5 cm. long; bracts 4 pairs, 5 mm. long or less, becoming fleshy at maturity; fruit a round fleshy, edible, cream-colored berry up to 1.1 cm. in diameter; seeds in pairs, oblong, triangular in cross section, 7 mm. long or less.

In sandy soil among native grasses, in "shinnery" among scrub oak, and occasionally on the gentle slopes of playa lakes. From Meadow to Tahoka south to Big Spring and Andrews, Texas. Specimens have been collected at Meadow, Brownfield, Wellman, Tahoka, O'Donnell, Lamesa

[1] Named in honor of my friend, Mr. V. L. Cory, Sonora, Texas, Range Botanist of the Texas Agricultural Experiment Station.

and near Ackerley, Texas. Type locality: Brownfield, Texas. Type specimens are in the National Herbarium, Smithsonian Institution, Washington, D.C. and in the Herbarium of the New York Botanical Garden, New York City, N.Y.

Its propagation is largely, if not entirely, by an elaborate system of underground rhizomes. A careful study of the seeds of two seasons has so far failed to show any with viable embryos and germination tests have proved equally unsuccessful. It is a "sand binder" and readily adjusts itself to the shifting sands of its habitat.

TEXAS TECHNOLOGICAL COLLEGE
LUBBOCK, TEXAS

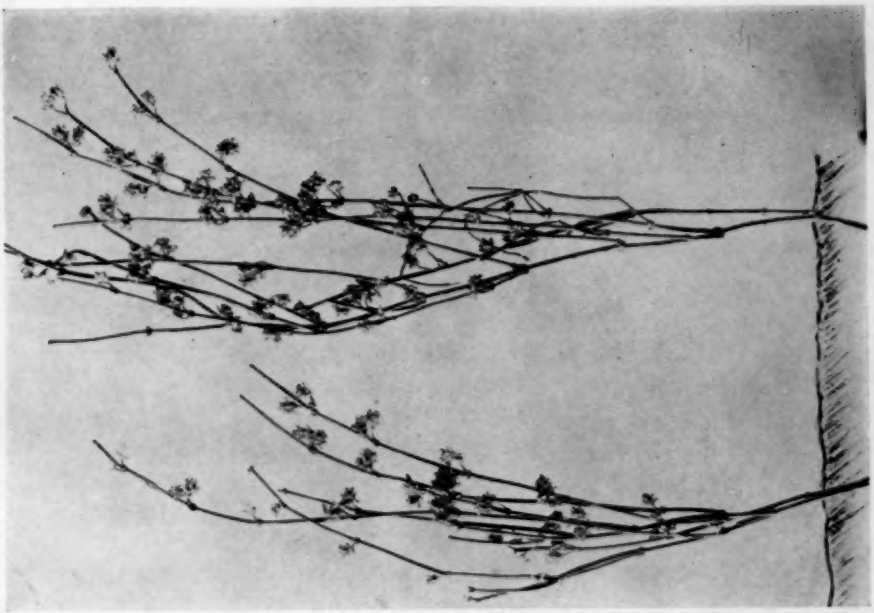

Fig. 1. Staminate plant of *Ephedra Coryi*, showing the amentssessile or on short stems of the season. ×½.

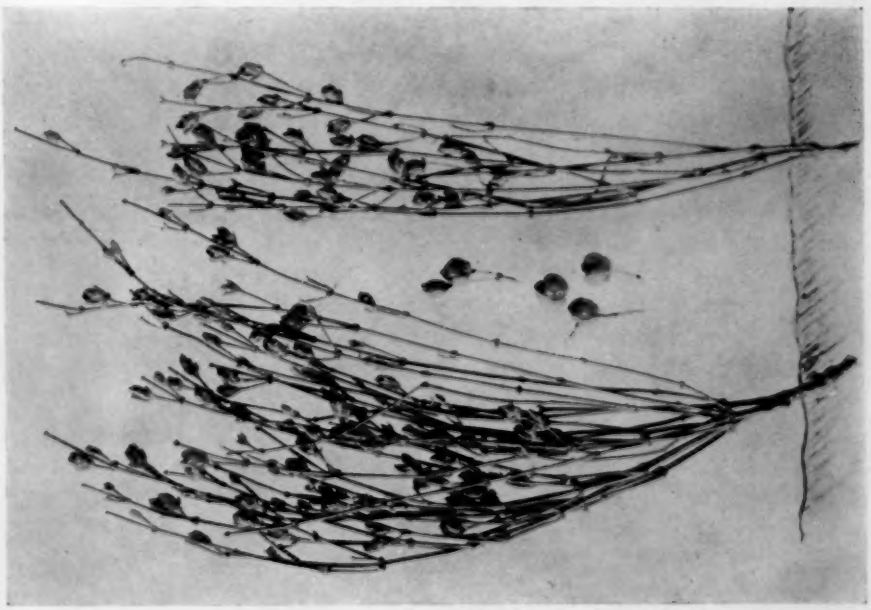

Fig. 2. Ovulate plant of *Ephedra Coryi*, showing the aments on short stems of the season, also a group of mature fruits. ×½.

INDEX TO AMERICAN BOTANICAL LITERATURE
1931–1936

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

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Alexander, E. J. An unsought adventure in the southern Catskills. Jour. N. Y. Bot. Gard. **37**: 42–46. *f. 1, 2.* F 1936.

Alexopoulos, C. J. A plant suitable for classroom demonstration of growth. Torreya **36**: 3–4. *illust.* Ja–F 1936.

Ashby, E. Hybrid vigor in maize. Am. Nat. **70**: 179–181. Mr–Ap 1936.

Azevedo, N. Nota sobre a *Diplodia* do Alzodoeiro. Rodriguesia 1^2: 97–98. *illust.* 1935.

Azevedo, N. A *Variola* do Mamoeiro. Rodriguesia 1^2: 91–93. *f. 1–4.* 1935.

Bailey, I. W. The problem of differentiating and classifying tracheids, fiber-tracheids, and libriform wood fibers. Trop. Woods **45**: 18–23. 1 Mr 1936.

Baker, M. S. Studies in western violets. I. Madrono **3**: 51–56. *pl. 2.* Ap 1935; II. 232–238. *pl. 11.* Ap 1936.

Bamford, R. The chromosome number in *Gladiolus*. Jour. Agr. Res. **51**: 945–950. *f. 1.* 15 N 1935.

Bannan, M. W. Vertical resin ducts in the secondary wood of the Abietineae. New Phytol. **35**: 11–46. *pl. 1+f. 1–23.* 27 F 1936.

Barros, M. Ciperaceas Argentinas. II. Generos *Kyllingia* Rosth., *Scirpus* L. y *Carex* L. An. Mus. Argentina Cien. Nat. **38**: 133–264. *f. 1–58.* 30 Jl 1935.

Barton, L. V. Germination of *Delphinium* seeds. Contr. Boyce Thompson Inst. **7**: 405–409. O–D 1935.

Bartram, E. B. Additions to the moss flora of China. Ann. Bryol. **8**: 6–21. *f. 1–13.* 1935.

Benatar, R. Fungos entomogenos dos *Citrus*. Rodriguesia 1^2: 7–10. 1935.

Berry, E. W. A fig from the Eocene of Virginia. Jour. Washington Acad. Sci. **26**: 108–111. *f. 1, 2.* 15 Mr 1936.

Blinks, L. R. The effects of current flow on bioelectric potential. I. *Valonia*. Jour. Gen. Physiol. **19**: 633–672. *f. 1–16.* 20 Mr 1936.

Blinks, L. R. The polarization capacity and resistance of *Valonia*. I. Alternating current measurements. Jour. Gen. Physiol. **19**: 673–691. *f. 1–5*. 20 Mr 1936.

Blodgett, E. C. The anthracnose of currant and gooseberry caused by *Pseudopeziza ribis*. Phytopathology **26**: 115–152. *pl. 1–3+f. 1–6*. F 1936.

Bomhard, M. L. Leaf venation as a means of distinguishing *Cicuta* from *Angelica*. Jour. Washington Acad. Sci. **26**: 102–107. *f. 1*. 15 Mr 1936.

Bonazzi, A. Estudios sobre fisiologia del arroz. Mem. Soc. Cubana Hist. Nat. **8**: 169–188. *f. 1–4*. Au 1934; II. **10**: 1–19. 10 Mr 1936.

Bornmueller, J. Florula Riograndensis bearbeitung der von Alfred Bornmueller in den Jahren 1903 bis 1907 in Rio Grande do Sul gesammelten Pflanzen. Rev. Sudamer. Bot. **1**: 129–148. O 1934.

Bowers, C. G. Rhododendrons and azaleas. Their origin, cultivation and development. i–xiv, 1–549. *illust.* New York. Macmillan Co. 1936.

Brade, A. C. Excursao á Santa Maria Magdalena. Rodriguesia 1^2: 99–101. 1935.

Brade, A. C. Excursao á Serra do Cipo e a Barreiro, no Estado de Minas Geraes. Rodriguesia 1^2: 103–106. 1935.

B[rade], A. C. Nepenthes. Rodriguesia 1^2: 115–116. *illust.* 1935.

Brown, A. B. Cambial activity in poplar with particular reference to polarity phenomena. Canadian Jour. Res. **14**: 74–88. *f. 1–4*. F 1936.

Brown, J. R. A *Sedum* which occurs in Texas. Desert **8**: 19. *illust.* F 1936.

Campos Porto, P., & Brade, A. C. Index Orchidacearum in Brasilia inter MDCCCCVI et MDCCCCXXXII explorata sunt. Rodriguesia 1^2: 11–76. 1935.

Carlson, E. M., & Stuart, B. C. Development of the spores and gametophytes in certain New World species of *Salvia*. New Phytol. **35**: 68–91. *f. 1–50*. 27 F 1936.

Clements, F. E. Nature and structure of the climax. Jour. Ecol. **24**: 252–284. *pl. 6–11*. F 1936.

Conklin, M. E. Studies of the root nodule organisms of certain wild legumes. Soil Sci. **41**: 167–185. *f. 1*. Mr 1936.

Coombs, S. V. From New York to Kirstenbosch and back. Jour. Bot. Soc. So. Africa **21**: 19–20. *pl. 5*. 1935.

Coombs, S. V. South African plants. House & Gard. **69**: 42–43, 82–86. *illust.* Mr 1936.

Coombs, S. V. Succulents in a South African garden. Jour. Cactus & Succ. Soc. Am. **7**: 133–135. *illust.* **Mr** 1936.

Core, E. L. The type localities of some plants first described from West Virginia. Torreya **36:** 7–13. Ja–F 1936.

Costa, A. S., & Krug, H. P. Eine durch *Ceratostomella* hervorgerufene Welkekrankheit der *Crotolaria juncea* in Brasilien. Phytopath. Zeits. **8:** 507–513. *f. 1–8.* 1935.

Coville, F. V. Rock midget, a new species of *Mimulus* from Death Valley, California. Jour. Washington Acad. Sci. **26:** 99–102. *illust.* 15 Mr 1936.

Davies, P. A. An abnormal method of branching. Bull. Torrey Club **63:** 139–146. *pl. 5+f. 1, 2.* 3 Mr 1936.

Dawson, Y. Cactus collecting in manana land. Jour. Cactus & Succ. Soc. Am. **7:** 115–117. *illust.* F 1936; 139–141. Mr 1936.

Dodge, B. O. Notes on some bacterial and fungous diseases in our gardens. Jour. N. Y. Bot. Gard. **37:** 29–33. *f. 1, 2.* F 1936.

Dodge, B. O., & Reed, G. M. Notes on rust diseases of *Sempervivum* and other ornamentals in the New York area. Jour. N. Y. Bot. Gard. **37:** 54–59. *f. 1–4.* Mr 1936.

East, E. M. Genetic aspects of certain problems of evolution. Am. Nat. **70:** 143–158. Mr–Ap 1936.

Eisenmenger, W. S. Toxicity of aluminum salts to tobacco plants. Jour. Agr. Res. **51:** 919–924. *f. 1, 2.* 15 N 1935.

Ekman, E. Contribution to the *Draba* flora of Greenland, VIII. Svensk Bot. Tidsk. **29:** 348–364. *f. 1, 2.* 1935.

Emig, W. H. The megagametophyte of *Pinus*. I. Introduction. Am. Jour. Bot. **22:** 500–503. *illust.* Ap 1935.

Evans, A. W. A study of five New England species of *Scapania*. Rhodora **38:** 77–90. Mr 1936.

Everett, T. H. *Begonia semperflorens* var. *indianferin*. Jour. N. Y. Bot. Gard. **37:** 34–35. *illust.* F 1936.

Ewan, J. Bibliography of the botany of Arizona. Am. Midl. Nat. **17:** 430–454. Mr. 1936.

Eyma, P. J. Notes on Guiana Sapotaceae. Rec. Trav. Bot. Neerlandais **33:** 156–210. *f. 1–3.* 1936.

Eyster, W. H., & Burpee, D. Inheritance of doubleness in the flowers of the nasturtium. Jour. Heredity **27:** 51–60. *f. 1–6.* F 1936.

F[airburn], D. C. Plant propagation. Missouri Bot. Gard. Bull. **24:** 45–63. *pl. 9–13+f. 1–4.* F 1936; 69–92. *pl. 14–24.* Mr 1936.

Fassett, N. C. Notes from the herbarium of the University of Wisconsin. XII. Rhodora **37:** 88–113. *pl. 328.* Mr 1935; XIII. **38:** 94–97. Mr 1936.

Fröderström, H. The genus *Sedum* L. Meddel. Göteborgs Bot. Trad. **10**[4]: 1–262. *pl. 1–115*+*f. 1–1360.* 1935.

Fulford, M. The genus *Bazzania* in the United States and Canada. Am. Midl. Nat. **17**: 385–424. *f. 1–12.* Mr 1936.

Garassini, L. A. El "pasmo" del lino *Phlyctaena ? linicola* Speg. Rev. Fac. Agron. Univ. Nac. La Plata **20**: 170–261. *f. 1–19.* D 1935.

Garratt, G. A. The wood of *Symphonia globulifera.* Trop. Woods **45**: 1–15. 1 Mr 1936.

Gilman, J. C., McNew, G. L., & Davis, G. N. Fungi associated with tree cankers in Iowa. I. Preliminary survey. Iowa St. Coll. Jour. Sci. **10**: 151–153. Ja 1936.

Gran, H. H., & Braarud, T. A quantitative study of the phytoplankton in the Bay of Fundy and the Gulf of Maine (including observations on hydrography, chemistry and turbidity). Jour. Biol. Bd. Canada **1**: 279–467. *f. 1–69.* My–Au 1935.

Griggs, R. F. Hepaticae as pioneers on nitrogen-free volcanic ash. Ann. Bryol. **8**: 74–79. *f. 1, 2.* 1935.

Groh, H. *Chenopodium polyspermum* at Ottawa. Canadian Field Nat. **50**: 53. 5 Mr 1936.

Hallenbeck, C. *Toumeya papyracantha* Eng. rediscovered. Jour. Cactus & Succ. Soc. Am. **7**: 131–132. *illust.* Mr 1936.

Halperin, M. Cereals and civilization. Sci. Monthly **42**: 355–364. Ap 1936.

Harland, S. C. The genetical conception of the species. Biol. Rev. Cambridge Philos. Soc. **11**: 83–112. Ja 1936.

Harmon, F. N., & Snyder, E. A seeded mutation of the Panariti grape. Jour. Heredity **27**: 77–78. *f. 10.* F 1936.

Hess, E. Effect of temperature on the cell length and shape of *Bacillus vulgatus.* Jour. Biol. Bd. Canada **1**: 109–119. *f. 1–6.* O–D 1934.

Hirschhorn, E., & Hirschhorn, J. Los carbones del maize en la Argentina. Rev. Fac. Agron. Univ. Nac. La Plata **20**: 108–139. *pl. 1–5.* D 1935.

Hitchcock, A. E., & Zimmerman, P. W. Absorption and movement of synthetic growth substances from soil as indicated by the responses of aerial parts. Contr. Boyce Thompson Inst. **7**: 447–476. *f. 1–4.* O–D 1935.

Hoehne, F. C. Contribuicoes para o conhecimento da flora orchidologica Brasilica. III. Bol. Agr. Sao Paulo **34**: 600–638. *illust.* 1933.

Hume, H. H. Distinguishing characters of Florida *Zephranthes.* Year Book Am. Amaryllis Soc. **2**: 87–88. N 1935.

Hunt, W. R. New rust species and hosts from Rhode Island. Rhodora **38**: 97–98. Mr 1936.

Isenbeck, K. Untersuchungen über die Physiologie von *Spacelotheca Sorghi*, den gedeckten Körnerbrand von Sorghum. Phytopath. Zeits. **8**: 165–182. *f. 1–5.* 1935.

Jacques, A. G. The kinetics of penetration. XII. Hydrogen sulfide. Jour. Gen. Physiol. **19**: 397–418. *f. 1–5.* 20 Ja 1936.

Jenkins, A. E. Australian citrus scab caused by *Sphaceloma Fawcettii Scabiosa.* Phytopathology **26**: 195–197. *f. 1.* F 1936.

Jenkins, A. E., & Giltner, L. T. Inoculation of rabbits with *Elsinoe ampelina.* Phytopathology **26**: 191–194. *f. 1.* F 1936.

Johann, H. Histology of the caryopsis of Yellow Dent corn with reference to resistance and susceptibility to kernel rots. Jour. Agr. Res. **51**: 855–883. *f. 1–19.* 15 N 1935.

Jones, D. F. Atypical growth. Am. Nat. **70**: 86–92. Ja–F 1936.

Jones D. F. Segregation of color and growth-regulating genes in somatic tissue of maize. Proc. Nat. Acad. Sci. **22**: 163–166. 15 Mr 1936.

Jones, L. K., Anderson, E. J., & Burnett, G. The latent virus of potatoes. Phytopath. Zeits. **7**: 93–119. *pl. 1–3.* 1934.

Jonker, F. P. Ueber einige Gentianaceae aus Surinam. Rec. Trav. Bot. Neerlandais **33**: 250–253. *f. 1.* 1936.

Keller, W. Inheritance of some major color types in beets. Jour. Agr. Res. **52**: 27–38. 1 Ja 1936.

Kittredge, E. M. Supplement to ferns and flowering plants of Woodstock, Vermont 1936. [1–7.] 1936.

Knoblock, I. W. Plant records from southwestern New York. Torreya **36**: 1–2. Ja–F 1936.

Knuth, R. Additamenta cognitionis Lecythidacearum. II. Repert. Spec. Nov. **38**: 113–117. 30 Je 1935.

Krantz, F. A., & Mattson, H. Periderm and cortex color inheritance in the potato. Jour. Agr. Res. **52**: 59–64. 1 Ja 1936.

Lanjouw, J. Studies in Moraceae. II. The genus *Clarisia* Ruiz et Pavon and its synonyms, with a discussion of the generic name. Rec. Trav. Bot. Neerlandais **33**: 254–275. *pl. 9–11+f. 1–3.* 1936.

Longley, W. H. Species studies and the species problem. Am. Nat. **70**: 97–109. Mr–Ap 1936.

Lovell, H. B., & Lovell, J. H. Pollination of the Ericaceae.

IV. *Ledum* and *Pyrola*. Rhodora **38**: 90–94. *f. 1, 2.* Mr 1936.

Lowry, W. E. Southern Texas cacti. Desert **8**: 20. F 1936.

McCool, M. M. Effect of light intensity on the manganese content of plants. Contr. Boyce Thompson Inst. **7**: 427–437. *f. 1, 2.* O–D 1935.

McGeorge, W. T. Some aspects of *Citrus* tree decline as revealed by soil and plant studies. Univ. Arizona Agr. Exp. Sta. Tech. Bull. 60: 329–370. *f. 1–3.* 15 F 1936.

Magnusson, A. H. On saxicolous species of the genus *Lecidea* proper to North America. Meddel. Göteborgs Bot. Trad. **10**: 1–52. *f. 1–27.* 1935.

Mansfeld, R. Gesneriaceae novae austro-americanae. II. Repert. Spec. Nov. **38**: 25–28. 5 My 1935.

Markgraf, F. Neue Apocynaceen aus Sudamerika. V. Notizbl. Bot. Gart. Berlin **12**: 295–301. 31 Mr 1935.

Mason, T. G., Maskell, E. J., & Phillis, E. Further studies on transport in the cotton plant. III. Concerning the independence of solute movement in the phloem. Ann. Bot. **50**: 23–58. *pl. 1+f. 1–9.* Ja 1936.

Meier, F. E. Growth of a green alga in isolated wave-length regions. Smithsonian Misc. Coll. 94^{17}: 1–12. *pl. 1.* 21 F 1936.

Meier, F. E. Lethal effect of short wave lengths of the ultraviolet on the alga *Chlorella vulgaris*. Smithsonian Misc. Coll. 95^{2}: 1–19. *pl. 1, 2+f. 1, 2.* 20 Mr 1936.

Merrill, E. D. Botany at Harvard University. Sci. Monthly **41**: 469–473. *illust.* N 1935.

Merrill, E. D. *Pavetta* in China (Rubiaceae). Lingnan Sci. Jour. **15**: 17–18. 30 Ja 1936.

Metcalf, F. P. A new *Salix* from Fukien (Salicaceae). Lingnan Sci. Jour. **15**: 11–12. *pl. 4.* 30 Ja 1936.

Michels, C. A. A study of the appearance of awn characters in a cross between Meloy and Faust barley. Am. Nat. **70**: 13–18. Ja–F 1936.

Miner, E. L. An interesting "Dadoxylon" from northern Illinois. Am. Midl. Nat. **17**: 455–459. *f. 1–7.* Mr 1936.

Morton, C. V. A check list of the bulbous Amaryllidaceae native to the United States. Year Book Am. Amaryllis Soc. **2**: 80–84. N 1935.

Mueller, C. H. New and noteworthy trees in Texas and Mexico. Bull. Torrey Club **63**: 147–155. 3 Mr 1936.

Myers, J. G. Savannah and forest vegetation of the interior Guiana plateau. Jour. Ecol. **24**: 162–184. *f. 1.* F 1936.

Nabours, R. K. Species from the genetic standpoint. Am. Nat. **70**: 191–192. Mr–Ap 1936.

Nelson, R. M. Effect of bluestain fungi on southern pines attacked by bark beetles. Phytopath. Zeits. **7**: 327–353. *f. 1–6.* 1934.

Newton, M., & Johnson, T. Stripe rust, *Puccinia glumarum*, in Canada. Canadian Jour. Res. **14**: 89–108. *f. 1.* F 1936.

Osterhout, W. J. V., & Hill, S. E. Nature of the action current in *Nitella*. III. Some additional features. Jour. Gen. Physiol. **18**: 499–514. *f. 1–15.* 20 Mr 1935.

Pacca, D. W. Sobre o "Diplodia" du Mandioca. Rodreguesia 1^2: 77–81. *f. 1–7.* 1935.

Patrick, R. Some diatoms of Great Salt Lake. Bull. Torrey Club **63**: 157–166. *pl. 6+f. 1.* 3 Mr 1936.

P[enna], L. A. Floração da Primavera. Rodreguesia 1^2: 109–113. 1935.

Pfeiffer, H. Conspectus Cyperacearum in America meridionali nascentum. VI. Repert. Spec. Nov. **38**: 88–99. 30 Je 1935; **39**: 38–43. 30 N 1935.

Phillis, E., & Mason, T. G. Further studies on transport in the cotton plant. IV. On the simultaneous movement of solutes in opposite directions through the phloem. Ann. Bot. **50**: 161–174. *f. 1–6.* Ja 1936.

Pierce, W. P. The relation between cell, nuclear and chromosome dimensions in a sterile violet species-hybrid. Bull. Torrey Club **63**: 115–138. *pl. 4+f. 1–3.* 3 Mr 1936.

Pilger, R., & Schulze, G. K. Uma nova especie de *Fuchsia* do Itatiaya. Rodriguesia 1^2: 94. *f. 1.* 1935.

Raber, O. Shipmast locust, a valuable undescribed variety of *Robinia pseudoacacia*. U. S. Dep. Agr. Circ. 379: 1–8. *pl. 1–6.* Ja 1936.

Reed, G. M., & Stanton, T. R. Reaction of oat varieties to physiologic races of loose and covered smuts of red oats. Jour. Agr. Res. **52**: 1–15. 1 Ja 1936.

Reeves, G. R., & Beasley, J. O. The development of the cotton embryo. Jour. Agr. Res. **51**: 935–944. *f. 1–3.* 15 N 1935.

Renn, C. E. The wasting disease of *Zostera marina*. I. A phytological investigation of the diseased plant. Biol. Bull. **70**: 148–158. *f. 1–7.* F 1936.

Rickett, H. W. *Cornus Drummondii*. Rhodora **38**: 99–100. Mr 1936.

Robinson, B. L. New Compositae and Eupatoriaceae from Brazil. Candollea **5**: 170–174. Ja 1934.

Rodrigues da Silveira, F. Queda das folhas. Rodriguesia **1**[2]: 1–6. 1935.

Romano Milanez, F. Estudo de um dicotyledoneo fossil do cretaceo. Rodriguesia **1**[2]: 83–89. *pl. 1–4.* 1935.

Rossberg, G. Zur Kenntnis der Westindischen Moraceen. I. Notizbl. Bot. Gart. Berlin **12**: 168–176. 31 D 1934.

Russell, T. A. Diseases and pests of tomatoes in Bermuda. Jour. Imp. Coll. Trop. Agr. **13**: 71–78. *f. 1, 2.* Mr 1936.

Salisbury, R. K. The desmids of Florida. Ohio Jour. Sci. **36**: 55–60. *pl. 1.* Ja 1936.

Schroeder, E. M. Dormancy in seeds of *Benzoin aestivale* L. Contr. Boyce Thompson Inst. **7**: 411–417. *f. 1, 2.* O–D 1935.

Seifriz, W. Protoplasm. i–x, 1–584. *f. 1–178.* New York. McGraw-Hill Book Co. 1936.

Setchell, W. A. Notes on *Microdictyon.* III. Univ. California Publ. Bot. **19**: 129–139. *pl. 13–15.* 11 S 1935.

Shapovalov, M., & Dufrenoy, J. Cytologische Beobachtungen an einer Viruskrankheit von Typus "streak" oder "strichel." Phytopath. Zeits. **8**: 297–301. *f. 1–8.* 1935.

Shaw, L. Intercellular humidity in relation to fire-blight susceptibility in apple and pear. Cornell Agr. Exp. Sta. Mem. 181: 1–40. *f. 1–11.* S 1935.

Shreve, F. The plant life of the Sonoran desert. Sci. Monthly **42**: 195–218. *illust.* Mr 1936.

Silveira, F. A respeito da *Maripa paniculata* B. R. e da *Mouroucoa violacea* Aubl. Rodriguesia **1**[2]: 107–108. 1935.

Skottsberg, C. Vascular plants from the Hawaiian Islands. II. Meddel. Göteborgs Bot. Trad. **10**: 97–193. *f. 1–23.* 1935.

Skovsted, A. Chromosome numbers in the Malvaceae. I. Jour. Genetics **31**: 263–296. *f. 1–125.* Au 1935.

Small, J. K. Epiphytic palms and cacti. Jour. N. Y. Bot. Gard. **37**: 60–65. *f. 1–3.* Mr 1936.

Small, J. K. The water-hyacinth a time-clock. Jour. N. Y. Bot. Gard. **37**: 35–41. *f. 1–4.* F 1936.

Sprecher v. Bernegg, A. Tropische und subtropische Weltwirtschaftspflanzen. III. Tee und mate. i–xvi, 1–432. *f. 1–42.* Stuttgart. 1936.

Standley, P. C. Four new trees and shrubs from Ecuador and Colombia. Trop. Woods **45**: 16–18. 1 Mr 1936.

Steffen, H. Ein Beitrag zur Flora von Alaska. Beih. Bot. Centralb. **54**: 547–556. *f. 1–3.* Ja 1936.

Stevens, O. A. Germination studies on aged and injured seeds. Jour. Agr. Res. **51**: 1093–1106. *pl. 1+f. 1–3.* 15 D 1935.

Stephenson, R. E. The nitrification process and plant nutrition. Soil Sci. **41**: 187–196. Mr 1936.

Stout, A. B. The species of daylilies. Year Book Am. Amaryllis Soc. **2**: 98–100. N 1935.

Strain, H. H. Leaf xanthophylls. Science II. **83**: 241–242. 6 Mr 1936.

Sydow, H. Novae fungorum species. XXII. Ann Myc. **32**: 286–299. 1934.

Thorne, D. W., & Walker, R. H. Physiological studies on *Rhizobium*. III. Respiration and growth as influenced by the reaction of the medium. Jour. Bact. **30**: 33–42. *f. 1–6*. Jl 1935.

Thornton, N. C. Factors influencing germination and development of dormancy in cocklebur seeds. Contr. Boyce Thompson Inst. **7**: 477–497. *f. 1–5*. O–D 1935.

Traub, H. P. Artificial reversal of growth dominance in amaryllids. Year Book Am. Amaryllis Soc. **2**: 109–110. N 1935.

Turrell, F. M. A list of early flowering herbaceous plants near Sorento, Illinois. 1–3. Iowa City. 1933.

Tiffany, L. H. New species of *Oedogonium*. Trans. Am. Micros. Soc. **55**: 1–5. *pl. 1*. Ja 1936.

Tryon, R. M. Ferns of the dune region of Indiana. Am. Midl. Nat. **17**: 425–429. Mr 1936.

Uphof, J. C. T. Dendrologische Notizen aus dem Staate Florida. V. Mitteil Deutsch Dendroll. Gesell. **47**: 39–53. *pl. 7+f. 1–9*. 1935.

Uphof, J. C. T. Vergrünung einer Blüte von *Darlingtonia californica* Torr. Ber. Deutsch. Bot. Gesell. **53**: 820–823. *f. 1, 2*. 30 Ja 1936.

Van Ooststroom, S. J. Beiträge zur Kenntnis der Sudamerikanischen Convolvulaceen. Rec. Trav. Bot. Neerlandais **33**: 211–222. *f. 1–3*. 1936.

Venkatarayan, S. V. The biology of *Ganoderma lucidum* on areca and cocoanut palms. Phytopathology **26**: 153–175. *f. 1–6*. F 1936.

Wagenaar Hummelinck, P. Notes on *Agave* in Aruba, Curaçao, Bonaire and some parts of the South American continent. Rec. Trav. Bot. Neerlandais **33**: 223–249. *pl. 1–8*. 1936.

Webber, J. M. Interspecific hybridization in *Gossypium* and the meiotic behavior of F_1 plants. Jour. Agr. Res. **51**: 1047–1070. *pl. 1–3+f. 1–12*. 15 D 1935.

Whitaker, D. M. The effect of white light upon the rates of development of the rhizoid protuberance and the first cell

division in *Fucus furcatus*. Biol. Bull. **70**: 100–108. *f. 1, 2.* F 1936.

White, R. P. Diseases of shade trees. Gard Chron. Am. **40**: 81, 98–99. *illust.* Mr 1936.

Woodruff, N. H. Soil acidity at the roots of some Tennessee Pteridophytes. I. Jour. Tennessee Acad. Sci. **11**: 31–52. *f. 4–6.* Ja 1936.

Wollenweber, H. W., & Reinking, O. A. Die Fusarien, ihre Beschreibung, Schadwirkung und Bekämpfung. i–viii, 1–355. *f. 1–95.* Berlin. 1935.

Wynd, F. L. The introduced flora of Crater Lake National Park. Torreya **36**: 5–6. Ja–F 1936.

Yeager, A. F. Root systems of certain trees and shrubs grown in prairie soils. Jour. Agr. Res. **51**: 1085–1092. *f. 1.* 15 D 1935.

Young, P. A. Distribution and effect of petroleum oils and kerosenes in potato, cucumber, turnip, barley, and onion. Jour. Agr. Res. **51**: 925–934. *pl. 1–3.* 15 N 1935.

Young, P. A. *Sclerotinia* rot of squash and pumpkin. Phytopathology **26**: 184–190. *f. 1, 2.* F 1936.

Yuncker, T. G., & Gray, W. H. Anatomy of Hawaiian Peperomias. Bernice P. Bishop Occ. Papers 10: 1–19. *f. 1–60.* 1934.

Zahlbruckner, A. Florida-Flechten gesammelt von S. Rapp. Ann. Myc. **33**: 33–45. *f. 1, 2.* 1935.

Zeller, S. M., & Dodge, C. W. New species of Hydnangiaceae. Ann. Missouri Bot. Gard. **22**: 365–373. Ap 1935.

Zimmerman, P. W. Anaesthetic properties of carbon monoxide and other gases in relation to plants, insects, and centipedes. Contr. Boyce Thompson Inst. **7**: 147–155. Ap–Je 1935.

Zimmerman, P. W., & Hitchcock, A. E. The response of roots to "root-forming" substances. Contr. Boyce Thompson Inst. **7**: 439–445. *f. 1, 2.* O–D 1935.

ZoBell, C. E. The assimilation of ammonium nitrogen by *Nitzschia Closterium* and other marine phytoplankton. Proc. Nat. Acad. Sci. **21**: 517–522. *f. 1.* 15 S 1935.